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ABSTRACT

This monograph contains five papers that discuss an eco-behavioral approach to psychology, special education, and applied behavior analysis. The papers point out the advantages of assessing ecological factors (such as natural stimuli and special education procedures) in a quantitative fashion and in a temporal relationship with student behavior. An introductory chapter by Charles R. Greenwood defines eco-behavioral research and indicates its potential benefits. The first paper, a literature review by Donald Dorsey, finds that frequently contradictory research on the effective use of instructional time should be made more precise and broader in scope, by pairing behavior analysis and ecological psychology. Next, Greenwood assesses eco-behavioral relationships in special education outcome research and argues for the development of a powerful, widely practiced technology of instruction. Carmen Arreaga-Mayer examines the literature dealing with ecological and teaching variables that affect the academic performance of culturally and linguistically different learners. Judith Carta proposes an eco-behavioral approach to evaluation of preschool programs for the handicapped, which allows for determination of early intervention effectiveness and specification of the factors responsible. Gary Verna examines theoretical and empirical issues related to current ecological developments within the field of applied behavior analysis. (JDD)

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AN ECO-BEHAVIORAL APPROACH
TO RESEARCH
IN SPECIAL EDUCATION

The University of Kansas
Bureau of Child Research and Departments of
Special Education, Human Development and Family Life

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AN ECO-BEHAVIORAL APPROACH TO RESEARCH IN SPECIAL EDUCATION

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A product of the Juniper Gardens Children's Project, Bureau of Child Research and Departments of Special Education and Human Development and Family Life

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PREFACE

From 1983 to 1986 the Special Education Program of the Department of Education supported a post-doctoral fellowship program in research at the Juniper Gardens Children's Project. The Children's Project has been a 20 year program in research and development concerning the problems of low income and minority group children and their families. Within the last seven years, research based upon an eco-behavioral interaction approach has evolved. Part of each post-doctoral fellow's requirements during their fellowship year was the development of a review paper in which each fellow examined an area of their interest from the perspective of an eco-behavioral approach. The results of these individual scholarly efforts are contained in this volume. The chapters span a range from the highly conceptual (i.e., the chapter by Verna), to a presentation at a conference on special education research (i.e, the paper by Greenwood), to reviews of the research literature (i.e., the chapters by Carta, Arreaga-Mayer, and Dorsey).

The major underlying theme to these works is an eco-behavioral interaction view of the educational process. An effort is made in the introduction to define eco-behavioral interaction research. However, since this research, as a content area and as a methodology is rapidly developing, the adequacy of this definition must be considered in light of continuing developments.

This monograph is intended for researchers in ecological psychology, special education, and applied behavior analysis who are interested in exanding their methodology to include the quantitative assessment of ecological and behavioral factors in their work. The benefits, significance, and dimensions of this approach will hopefully be revealed in this monograph.

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CHAPTER I

INTRODUCTION

CHARLES R. GREENWOOD

An emerging trend in research is analysis of ecology-behavior interaction. The assessment of eco-behavioral interaction is based upon recordings of the momentary interactions of environmental stimuli and a person's behavior. Examination of the behavioral assessment literature, however, reveals that traditional forms of assessment have focused almost exclusively upon the characteristics and behaviors of the child or adult (McReynolds, 1979). Assessment of child status alone, however, does not provide important information about either the immediate or historic conditions within the child's ecology, which may contribute to child growth and development (Bijou, 1981). Thus, important information concerning the dynamic interrelationship between child behavior and the environment remains largely unknown (Bronfenbrenner, 1979; Brophy, 1979).

Natural science approaches to behavior analysis have been based upon theoretical conceptualizations of eco-behavioral interaction for years (Barker, 1961; Kantor, 1954; Skinner, 1953), yet empirical data in this area has been forthcoming only in the last 10 years. In applied research particularly, this has been the direct result of technology advances, particularly in computer-assisted observation systems. These systems have enabled researchers to gather and analyze complex information on the structure, sequence, and function of eco-behavioral phenomena. A premiere example of this research is that of Patterson and his colleagues (Patterson, 1982). Their coercive theory of aggression is based upon sequential analysis of child-adult interaction records. This procedure allows the investigator to examine the stimulus controls operating within natural settings. The approach is based upon conditional probability relationships between the behaviors of interacting persons. Thus, in Patterson's work it is possible to identify a followed six seconds later in time by child *yell*. Since there are no theoretical limitations on the time interval between events (only the length of the data record imposes limitations), it is possible to study the distal impact of particular stimuli or setting events upon specific interaction patterns, like the one between parent and child just mentioned. For example, Karpowitz and Johnson (1982) examined the relationship of social

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This introduction is based upon Greenwood, C. R., Schulte, D., Kohler, F., Dinwiddie, G. & Carta, J. (in press). Assessment and analysis of eco-behavioral interaction in school settings. In R. Prinz (Ed.), *Advances in behavioral assessment of children and families*, (Vol. II), Greenwich, CT: JAI Press.

stimuli to child behavior at 10 seconds versus 30 seconds apart. They concluded that the immediately preceding stimulus (10 seconds earlier) was most predictive of child response. Other researchers are currently applying these methods to applied problems in families; Biglan, et al., 1984; Hops et al., 1984; family therapy, Wahler & Graves, 1983; language development, Hart & Risley, 1984; peer social interaction, Greenwood, et al., 1982; Kohler, 1984; and classroom instruction; Brophy, 1979; Greenwood, et al., in press.

Definition of Eco-Behavioral Research

Eco-behavioral research implies assessment and intervention designed to reveal sequential and concurrent interrelationships between environmental stimuli and organism response. A goal of eco-behavioral assessment is to assess both the physical and social stimuli temporally associated with behavior. This goal differentiates eco-behavioral assessment to some degree from other forms of sequential assessment commonly referred to as "social interaction" (Cairns, 1979; Lamb, Suomi, & Stephenson, 1979; Patterson, 1982). Social interaction research has emphasized assessment of reciprocal social stimuli within dyadic interaction. It has not broadly assessed physical stimuli in relationship to subject behavior.

We have used the term "eco-behavioral" in our work in classrooms: (a) to refer to the measurement of a broader constellation of stimulus events than just person-person interaction (i.e., the curriculum, physical arrangements, and teacher behavior) and (b) to denote the non-social character of these stimulus events. Our interest has been in discovering the momentary instructional forces that effect student's academic performance in the classroom. Thus, in our work we have included the subject matter, instructional materials, physical grouping, teacher location, and teacher behavior, which are the general and specific contexts for student's classroom behavior.

In eco-behavioral assessment, ecological and behavioral variables are sampled in close temporal relationship (10 second intervals). By systematically alternating sampling of ecological followed by behavioral variables, changes in environmental stimuli and behavior are recorded in sequence. Thus, an observer records the teacher's behavior in an interval just preceding the recording of the student's behavior. In this fashion, the sequence teacher instruct, followed by student read aloud may be recorded. By alternately sampling the teacher, then the student, the contextual basis for student behavior is included within the record for later analysis.

Limitations Imposed by Traditional Observational Assessment

The rather voluminous observational literature in education, for example, is devoted to complex assessments of classroom climate, school ecology, and teacher-student interaction. In fact, Flanders (1970) in his studies of teacher-student interaction, was perhaps the first to use an interaction matrix to relate teacher and student events. The rather pervasive problems with these observational studies, however, are that: (a) the variables measured are not defined as observeable events, (b) interobserver reliability is either not conducted or is low and inadequate, (c) the data are simply descriptive and static, that is, sequential relationships cannot be expressed in the data, and (d) the theoretical assumptions upon which the codes are based do not permit scientific investigations of direct environment-behavior influence (for a notable exception see Brophy, 1979) .

In applied behavior analysis and social learning theory, however, we have a tradition of observational assessment that meets rather stringent requirements of reliability and that has been productively used in behavior change studies. However, this assessment tradition has focused strictly upon measuring the subject's behavior and has rarely included measurement of the environment. While behavioral assessment has been very effective within the context of specific behavior change experiments, it has not produced quantified descriptions of the settings and stimuli within which these behavior changes take place. Neither has behavioral assessment provided information concerning the putative natural conditions which create developmental deficits and behavior problems which behavior analysts are called upon to correct. As Patterson, 1982, pointed out, "a science can be only as good as its assessment methodology". For many of the behavioral phenomena we would like to predict and control, assessment of behavioral events, in the absence of ecological variables, will be insufficent. Without information on natural controlling relationships and subsequent tests of their causal status, the field will continue to confront problems, such as the failure of behavior changes to maintain or of some children to achieve in school. As Wahler and Fox, 1981 pointed out, there has not been sufficent research attention paid to the structure and function of setting events or stimulus controls in applied behavior analysis. We would argue that this is largely the result of new methodological problems related to use of interactive assessment in applied settings. However, other reasons are apparent.

Our tradition of experimental research by necessity has limited wide expression of setting variables due to the need to maintain experimental control. As a result, setting factors have more often been considered troublesome confounds, rather than as independent variables in much of behavior analytic research (Foster & Cone, 1980; Rogers-Warren & Warren, 1977). Thus, one may argue that many of our most prized functional relationships have been established within narrowly defined setting conditions. Setting conditions or contexts are the establishing factors within which functional relationships will operate (Larsen, & Morris, 1983; Larsen, Morris, & Todd, 1984; Leigland, 1984; Michael, 1982). Reinforcement, for example, can only operate to strengthen behavior under specific conditions of deprivation and subject history. Change these contexts and you change the functional relationship. Unfortunately, we often do not know how functional relationships hold up within extremes of setting variation as occurs in the natural setting. The classic example of this point, for which we have yet to supply an adequate answer, is, "How do schedules of reinforcement, (revealed within controlled research), operate to strengthen and maintain behavior in natural settings"?

It also can be argued that much of our current knowledge of behavior change is based upon data in which setting variation was simply ignored. Reflected as variability in our baseline and treatment data, is the operation of many setting variables for which we have no explanation or information since we choose not to assess them. Setting variations very likely operate to enhance or retard subjects performance.

As a result of both conceptual and methodological problems, we may find that we are unable to generalize our results to specific contexts in which our target behavior occurs. This problem is particularly evident within studies of generalization and maintenance of behavior change wherein the setting dimensions important to these phenomena were not included in the initial analysis. One means for representing both the immediate and delayed setting factors in applied research is through interactive eco-behavioral assessment.

Potential Benefits of an Eco-Behavioral Interaction Approach

The solution to many of our current social problems (i.e., academic retardation, effective special education treatments), may require a more fundamental understanding of eco-behavioral process. The benefits of an eco-behavioral interaction approach lie in several important areas. First, the recording of ecological variables, describes natural stimuli, their normative rates of occurrence, and their probability relationship to behavior. As noted by Barker (1963), and more recently by Bronfenbrenner (1979), there is no definitive data base on human behavior and its settings. Second, use of an eco-behavioral approach as a process variable enables research on resulting developmental impact or outcome (e.g. academic achievement). It is possible to develop base rates and base proabilities on eco-behavioral variables against which the effectiveness of interventions can be assessed. Third, examination of the conditional relationships between ecological variables and behavior, may enable identification of particular ecological arrangements correlated with high levels of criterion behaviors. By identifying these arrangements in high performing subjects, it may be possible to test these natural arrangements for function when introduced to the environments of lower performers. Fourth, experiments testing these specific eco-behavioral hypotheses with low performers could yield information concerning their causal status. Fifth, structural information from an eco-behavioral code, defining standard and effective treatment formats, could be used to study the implementation of treatment by teachers over time. Thus, it might be possible to identify and analyze factors that interfere with standard implementation or that facilitate maintenance of it.

The importance of an eco-behavioral interaction approach lies in its potential as a tool for exploring the effects of natural stimuli in the natural environment. Using this methodology, it may be possible to develop precision interventions based on eco-behavioral data that will be effective both in the initial stages of treatment and in generalizing and maintaining behavior change. In 1967, Patterson (1967) called for reprogramming the natural agents within environments to address the problem of maintenance. This involved training of natural agents in the use of contingency management procedures. Yet, this problem of limited generalization and maintance remains with us today. While we have been successful training natural agents, perhaps, we have armed them with procedures that simply cannot survive unaided in the natural setting. We need to sufficently understand the function of natural stimuli in these environments. As with other approaches to assessment, the importance of the eco-behavioral approach will be its contribution to our ability to predict and control behavior in applied settings.

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CHAPTER II

AN ECOLOGICAL-BEHAVIORAL VIEW OF INSTRUCTION TIME

DON DORSEY

Abstract

The effective use of instruction time has emerged as a major concern of parents, educators, and even of the United States Government. Tinkering with the length of the school day or year, along with school board mandates for more required instruction, are popular solutions for reversing the slide from academic excellence that began in the 1960's. Since Carroll (1963) introduced instructional time as a component of pupil progress, interest in the area grew gradually, until now there is a fairly large body of research. However, educators have found little guidance or comfort from this welter of data, because the results are frequently contradictory. Two steps need to be taken to reduce the research conflicts that have hobbled educators. The first step is precision. Precise language, precise measurement of both independent and dependent variables, and precise application of appropriate experimental designs will result in data that are understood and believed. The second step is: Take one step back. The view from one step back is broader, and will allow researchers to place instructional time in the context of the classroom and school day. This two-step process pairs the somewhat reluctant partners of behavior analysis and ecological psychology. Whether a two-step to the music of instructional time will lead to a liaison or a brief twirl, neither partner knows for sure. However, if an ecological-behaviorl approach can resolve some of the contradictions in instructional time research, it will have been worth the fling.

Introduction

Instructional time, the current hot property in the Ed Biz, has come to public attention through the President's Commission on Education in America. The Commission (1983) reported that European students get more of it than American children do, and we should increase instructional time if America is to retain its slim competitive edge in trade and technology. Since Carroll's (1963) theoretical analysis of the relationship of instructional time to teaching and learning, interest in the topic has built slowly, until now there is a fairly substantial body of literature. Yet that literature is diverse and contradictory, and basic questions such as the optimal amount of instructional

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This Chapter is based upon a paper presented by the author in 1984 at the Tenth Annual Meeting of the Association for Behavior Behavior Analysis, Nashville, TN.

time for different subjects at different ages, or how to allocate instructional time, remain unanswered. Where research has addressed basic questions, the answers are sometimes contradictory. For instance, Husen (1967) conducted a massive international study of mathematics, and concluded that instructional time contributed perhaps 3% of the assignable variation on total math scores. Yet other researchers (Greenwood, Delquadri, Stanley, Sasso, Whorton & Schulte, 1983; Rosenshine, 1978) assert that instructional time, particularly if it is well structured, is a major contributer to pupil progress.

How is it that despite a history of more than twenty years research, educators are unable to agree on the nature of instructional time, it's effects on achievement, or even how to increase it? From the beginning, instructional time research has been approached from several theoretical perspectives, has used a startling number of experimental designs, has sometimes used peculiar vocabulary as if it were generally understood, and most grievously, has often failed to specify the independent and dependent variables under study. It is not surprising, then, that teachers and educators are still waiting for clear principles and useful teaching practices to emerge from instructional time research. The President's Commission has taken the common sense approach that instructional time is a necessary ingredient if children are to learn skills. And the American public seems to agree. Teachers, however, must have more than a common sense notion of instructional time if they are to use the school day most effectively. One way to bring order to this area is to observe precisely in schools, to use experimental designs chosen specifically to control for the complex nature of real classrooms, to use a vocabulary of carefully defined terms, to specify both the independent and dependent variables cleanly, and to make some allowances for the school setting itself. Such an approach can be called ecological-behavioral, and it can be used with many educational questions, though it seems to have a special potential for bringing order to the instructional time question. A brief consideration of these steps may illustrate the usefulness of the ecological-behavioral approach to educational research.

Precisely Defined Terms

One source of confusion in instructional time research has been the cavalier tendency to use some terms as if they were both interchangeable and mutually understood. Thus, time, teaching time, instructional time, allocated time, scheduled time, on-task, engaged time, and other terms have been tossed into a research stew. Results, not surprisingly, have been mixed. Karweit and Slavin (1981) have addressed this issue directly. They found that scheduled instructional time and teacher reports of daily schedules, had no relation to pupil progress in grades 2-3, and a weak relationship to pupil progress in grades 4-5 on the California Test of Basic Skills (CTBS). In fact, they found that scheduled instructional time did not correspond closely to actual instructional time. Teachers' instructional schedules tend to the optimistic, something noted by Smith (1979), as well as Hook and Rosenshine (1979). Despite the unreliability of teachers' reporting their own scheduled instructional time as the independent variable.

Smith (1979) correlated unverified teacher reports of instructional time use with the STEP II social studies test, and found that instructional time was weekly correlated with achievement (r=.23). She found that measures of static variables, IQ for example, were more highly correlated with achievement on the STEP II test (r=.63). Jarvis (1962) conducted a massive study of Texas Gulf Coast schools and concluded that reading should not be scheduled for more than 50 minutes per day, because schools scheduling more than that learned less! His measure of instructional time was even more removed from the classroom than was Smith's. Jarvis got his independent measure, allocated time, by writing to schools, asking them what the school district guidelines were for instructional time, and how well they were complying with the district policy. No attempt was made to observe instructional time directly. It is naive to assume that school personnel can accurately fill out a questionnaire about how well they comply with district policy. One does not even know if the questionnaires were completed by principals, counselors, teachers, or secretaries.

Kiesling (1975) studied 5,800 children to test for the effects of "instructional time" on criterion-referenced and norm-referenced tests. What Kiesling called "instructional time" was actually scheduled time taken from teacher reports and interviews. No direct observation was made, and Kiesling reported that scheduled time had a slight effect on criterion-referenced tests, and no effect on norm-referenced tests.

Smith (1979) and Kiesling (1975) studied scheduled instructional time, whereas Jarvis (1962) studied allocated instructional time. None of them defined the terms they were using, except to take what information was offered to them by teachers, school officials, and school board policy. In no case were children or teachers observed to see if reports of use of time were accurate. Given what Smith herself and others have observed about the accuracy of teacher reports, it is doubtful that these data are reliable or valid. In addition, Smith (1979) said that a panel of experts found that the STEP II test she used as a dependent variable was an inappropriate measure, because there was so little correspondence between what the children were taught and the test items that the results could not be offered with confidence.

Perhaps the best illustration of how precisely defined terms can sort the significant from the muddy was provided by Karweit and Slavin (1981). They looked at the different effects that instructional time had on achievement depending on the kind of measurement used. Their research spoke directly to the confusion generated by researchers using vaguely defined independent measures. In the Karweit and Slavin work, pupil progress was correlated with four kinds of instructional time: teacher-scheduled time; actual minutes allocated; engaged time; and engaged rate. The measure of teacher scheduled time was taken from lesson plans. Actual minutes allocated was tallied from direct observation of the number of minutes spent teaching, a distinct departure from many earlier studies. Engaged time was defined as that part of the instructional period in which a student is on-task, or interacting with the materials. Engaged rate was defined as engaged time per actual minutes allocated. Except for teacher-scheduled time, these measures were obtained through direct observation. Karweit and Slavin found distinctly different relationships between these four measures of instructional time and achievement on the California Test of Basic Skills. "The detection of effects of time measures is sensitive to the proximity of the measurement used, with the measures most accurately reflecting individual students use of time showing the strongest effects" (p. 165). That is, the more precisely the independent variable is measured, the more likely it is to show an effect.

In their emphasis on measuring the effects of instructional time on individual students, Karweit and Slavin are following a line of research that began with Bloom in 1956. Though that line has been productive, it has not gone unchallenged in the clash of theoretical viewpoints.

Divergent Theories: Different Procedures Mean Different Results

In a Walt Kelly comic strip, Pogo was elucidating a political question for an insect. It was all a matter of view point, explained Pogo. The insect looked up and replied, "From where I stand, there's only one point of view".

Two distinct points of view guide instructional time research, each proposing different methods, and producing different results. Bloom (1956, 1967) argued that learning takes place in individuals, thus each student is the proper unit of interest. Smith (1979) criticized Bloom for this, preferring to use the classroom as the unit of analysis so that data could more easily be gathered and submitted to statistical analysis. Those opposing points of view underline most of the instructional time research, leading experimenters to ask different questions, use different methodologies, and to produce results that are sometimes in disagreement. Before Bloom (1956) instructional time researchers were concerned with how variables affected the average gain of a class, a school, or a district. Naturally, demonstrating changes in the mean level of pupil progress took large numbers of students and required a statistical analysis to interpret the results. Representatives of this line of research generally correlated results of standard tests with reports of instructional time use and found that instructional time was a weak contributer to achievement. Under these circumstances static variables such IQ, income level, and fathers' jobs were more highly correlated with achievement than instructional time variables. For instance, Husen (1967) engineered a massive and influential study that included the role of instructional time in achievement.

Husen's (1967) international study of mathematics was a large scale effort to describe the instructional and familial components of mathematics achievement in 12 countries. More than 132,000 students and some 13,300 teachers were involved in this effort. From their data Husen concluded that instructional time and homework variables together accounted for only 3% of the assignable variation in the total mathematics score, a trivial contribution. Far stronger, in Husen's view, was the contribution of static variables--a point that was to be echoed by Smith in 1979. How could this study, involving distinguished researchers from around the globe, come to the astonishing conclusion that homework and instructional time contributed virtually nothing to mathematics achievement scores? The strength of this study is that its data are uninterpretable. Husen admitted that he had little control over his independent and dependent measures. The independent variables, assigned homework, family income, instructional time, etc., were collected differently from one country to the next, and in no case was direct observation used. Various kinds of surveys or estimates from headmasters and government officials provided the data. The dependent measures inspired a similar lack of confidence in their reliability. The mathematics tests were constructed and translated into the 8 languages used by children in this study. Difficulties in translation and testing conditions led Husen to warn the reader that, "even as regards certain basic statistical information, such as per pupil expenditures or enrollment figures, there is a lack of uniformity in data reporting" (p. 287). Husen (1967) went on to say, "the difficulties indicated above should be kept in mind when interpreting some inconsistencies that appear in the findings" (p.287.). One of the most glaring inconsistencies is the assertion that instructional time and homework account for negligable effects on mathematics performances. While Smith (1979) Husen (1976) and other exponents of research that looked at mean differences continued to publish, a parallel course of development was charted by researchers who were interested in the individual. These two lines of research go on with little crossover or impact on one anothers' work. Carroll presented his "Model of School Learning" in 1963, and in one stroke showed that time could be treated as an independent variable, and that individual students were the most important unit of interest. The model says: time to learn a task is a function of aptitude in a child's repertory, minus time saved by previous learning.

Carroll realized that the quality of instructional time, as well as the history of each student, influenced the rate of learning. Bloom (1974) used this time-based model as the foundation for mastery learning. He claimed that most students could learn most skills if enough instructional time were provided. In summarizing the strengths of a time-based model, Bloom (1974) noted that: time can be measured with precision that is rare for educational variables; time can be measured on an interval scale, with each unit of measurement equal, and with an absolute zero; time can be used as a base to measure costs of instruction; perhaps most importantly time can be a measure of instructional effectiveness.

Among the researchers who have followed the Carroll-Bloom line are Bennett (1976), who was forced to look at the classroom ecology to account for unexpected results; Rosenshine and Berliner (1978), who focused the concept of instructional time into academic engaged time; the Beginning Teacher Evaluation Study group (BTES), who sharpened the concept of on-task; the Juniper Gardens research group, who collectively developed and tested the concept of opportunity to respond. The work of this somewhat divergent group shares several characteristics. These researchers assume that individual students are the unit of interest, because learning takes place with the child, not with the classroom or school. This group of researchers has evinced a determination to pursue instructional time in its simplest form, pealing away extraneous constructs, and measuring time as it is actually used by children and teachers. One other common thread may be the most important. This group of researchers directly observes the phenomena of interest, and measures them precisely. Questionnaire research--hypotheses by mail--will not be found in this body of work.

Bennett's work (1976) is particularly interesting because it shows the persistence of a researcher trying to account for unexpected results. This persistence took Bennett from his original line of inquiry and led him to examine instructional time. Bennett set out to compare the effects of teaching styles on cognitive and social development of elementary students in the United Kingdom. His independent variable was continuum of twelve teaching styles, from formal to informal, with various mixtures in between. Formal classes were teacher directed and curriculum oriented. Informal classes had flexible physical structures, allowed students wide ranges of choice, and encouraged independent work. Mixed classes had various proportions of these characteristics, and others such as homework assignments, freedom to move in the classroom, and other descriptive variables. Bennett found that children in informal classes did significantly poorer in reading than children from formal or mixed classes. In mathematics children from formal classes gained skills at about twice the expected rated, whereas children from mixed or informal classes gained skills at about half of the expected rate. The rate differences in mathematics culminated in achievement diffences of 3-4 months of pupils progress per year. These puzzling differences in mathematics culminated in achievement sent Bennett back to his data and the classrooms. His post-doc analysis showed that the critical differences between formal and other classes was the amount of structured learning time available.

Rosenshine and Berliner have used Carroll's framework to extend and develop some of the ideas in the Model of School

Learning. In a series of papers (Rosenshine, 1976, 1978; Rosenshine & Berliner, 1978) they developed the related concepts of academic engaged time and direct instruction. They saw their work as significant partly because it focused attention on dynamic variables (socio-economic status, birth order, IQ) that held little significance for policy or for teaching. Academic engaged time, as developed by Berliner and his colleagues Berliner, Fisher, Filby & Marliave, (1976) refined the definition of on-task, and made it a more active concept. Academic engaged time was defined as content covered in combination with student attention to materials. Of course, these kinds of data can only be collected by going into classrooms and watching children. Rosenshine (1976, 1978) made an additional point: children learn through direct instruction, not by accident or through self-directed discovery. Bennett's (1976) work confirmed this point. In child-centered classrooms children failed to learn academic subjects, mainly because they were never exposed to the curriculum. Left to choose, most children choose math, spelling, and grammar. By contrast, children in structured classrooms do well in academics precisely because they are taught a curriculum, given homework, expected to master specific skills, and have large blocks of time devoted to practice and mastery.

Perhaps no group of researchers has pursued the concept of instructional time as extensively as the Juniper Gardens group. In a series of papers the concept of opportunity to respond was developed (Delquadri, Greenwood, Stretton, & Hall, 1983; Greenwood, Dequadri, Stanley, Sasso, Whorton & Schulte, 1981; Hall, Delquadri, Greenwood & Thurston, (1982). By opportunity to respond they meant the amount of time available for active practice of the skill of interest. In spelling, for instance, opportunity to respond refers to practicing the writing or oral spelling of the words to be mastered. It does not mean using a spelling word while telling a story to the class, or drawing a line from the spelling word in one column to a list of definitions in another column. If the skill of interest is learning French vocabulary, then seeing a film about France does not qualify as opportunity to respond. Active responding is essential.

The concepts of academic engaged time, direct instruction, and opportunity to respond, share several characteristics. First, they are direct measurements of how children and teachers spend their time. These data cannot be collected any other way. Secondly, each has gone beyond the more passive concept of on-task, which by itself says nothing about how a child spends time, merely that the child is non-disruptive. Thirdly, each of these concepts is tied directly to student achievement. When academic engaged time, or direct instruction, or opportunity to respond are increased, reliable increases in student skills follow. that is not too surprising. That a child must practice the multiplication tables before they can be mastered may be self evident, yet such a simple concept is only gradually being accepted by education researchers.

In addition to refining instructional time into its components, practice, reinforcement, and error correction, the Juniper Gardens group have taken another tack. They have taken the one step back and watched the instructional activities with the eye of an ecological psychologist. They have begun to seek contexts for teaching and learning so that instructional activities that contribute most directly to learning can be used. This effort has involved collecting extensive ecological data, and associating various activities and techniques with specific student outcomes. The Code for Instructional Structure and Student Academic Response (CISSAR) is a system of observation that simultaneously tracks classroom structure, teacher activity, and child responding. It is sensitive enough to show, for instance, that using educational media is less effective than paper and pencil for teaching skills. By focusing on these ecological variables the Juniper Gardens group has extended the traditional preoccupation of behavior analysts with consequences.

If I Could Save Time in a Bottle, or: Where Do We Go From Here?

Two lines of instructional time research have been contrasted, and it seems evident that the most productive work has come from researchers who have hewed to precise observation, precise definition of terms, and assiduous selection of design. Further, some researchers have added the dimension of ecological observation to the powerful tools of behavior analysis. The resulting science shows promise because it holds the secret of self correction: the ability to frame mutually exclusive hypotheses. Research that is descriptive or correlational may be necessary in the early stages of delimiting research questions. But as Platt (1964) stated so forcefully, only research that can reject one of two mutually exclusive hypotheses is capable of advancement. The rest is a Sargasso Sea of aimless hypotheses and endless circular debate. A behavior analytic approach to instructional time can provide the structure for framing those hypotheses and the ecological perspective can insure that such research is conducted in a meaningful context.

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CHAPTER III

ASSESSING ECO-BEHAVIORAL RELATIONSHIPS IN SPECIAL EDUCATION OUTCOME RESEARCH OR "WHERE IS THE INDEPENDENT VARIABLE"?

CHARLES R. GREENWOOD

Abstract

Much of special education is concerned with issues associated with the identification and placement of children into special education programs. Risking oversimplification, my observation is this, *if we had a powerful science and technology of instruction that was widely practiced, it would seem that the issues of student identification and placement would be eliminated from special education or at least drastically reduced to a sharp focus upon the problems of teaching and instruction.* Specifically, I intend to address in this chapter issues related to the eco-behavioral process assessment of instruction, process-achievement relationships and their implications for research on instruction.

The Problem

The problem we all share, of course, is the fact that under our current educational practices, there remains wide variance in students' rates of academic development over their time in school. Historically, we have looked "inside" the child to account for this variance. I am sure you will agree that a majority of our research literature in special education is of this type. This literature has looked for brain damage, delays in development, loss of sensory and perceptual functions, strong and weak modalities, loss of cognitive processes, etc. This literature has given us instructional strategies that have attempted remediation of delayed developmental stages prior to teaching academic skills or which have sought matching instruction to student strengths in the central nervous system, in cognition, in sensation, in perception, and/or in modalities. More recently in our history, however, we have had moments when we have looked at the environment and at environmental deficits to account for this variance. We have assessed the physical setting, looked at student's home environments for differences in culture, language, and economics, assessed teacher skills and training, etc. Based upon this literature, we have modified the physical environment within the classroom, purchased new curricula, increased or decreased the length of the school day, developed new service delivery patterns, provided students with meals and health services, increased teacher certification requirements, created new instructional environments (e.g,

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resource rooms), introduced the most modern electronic technologies, reduced or increased stimuli, etc. And yet, the problem remains with us; the variance in academic development persists in the face of these substantial, costly, and certainly dramatic efforts. Based upon the most recent research, however, we are now just realizing that it may be the interaction between each student's instructional environment and behavior that accounts for this variance.

An Ecological-Behavioral Interaction Approach

An eco-behavioral interaction approach to the problem of variance in students development is not new in theory (Bijou, 1979; Bijou, Peterson, & Ault, 1968; Bronfenbrenner, 1979; Brophy, 1979; Dunkin & Biddle, 1974; and Lindsley, 1964) or instructional practice (cf. Becker, 1977, 1978). In fact, instructional practices based upon the general operant model (e.g., antecedent stimulus, student response, consequent stimulus), an environment-behavior interaction theory, have had substantial impact upon the development of effective instructional systems (Leinardt, Zigmond, & Cooley, 1981). Direct instruction, precision teaching, and personalized systems of instruction, are all specific examples of effective instructional systems based upon an environment-behavior interaction approach. What is new, however, are direct assessment measures that can provide an analysis of this ongoing interaction within a classroom setting.

An eco-behavioral assessment of instruction captures both the important ecological variables in the classroom (e.g, teacher behavior, grouping arrangements, tasks, activities of instruction, etc.), and specific student behaviors (Graden, Thurlow, & Ysseldyke, 1983; Stanley & Greenwood, 1981). Since these ecological variables are represented within the observational record frequently and systematically, the student's behavior can be analysed in relationship to these important variables. One of the fundamental problems in past educational outcome research has been the inability to obtain such an important measure of the educational experience (Brophy, 1979; Good, 1979; Strain & Kerr, 1982). As a result, we have not been able to explain the results of most outcome/efficacy studies, even in well-controlled outcome research. When outcome research focuses soley upon assessment of outcome variables (i.e., tests, grades, etc.), we simply cannot meaningfully relate outcomes to events that transpired within the program. Frankly, because of this limitation, we can no longer afford to conduct outcome research in the absence of high fidelity process measures.

The data in Table 1 illustrate the results of an eco-behavioral process assessment of one student's instructional day at school. The Table is organized by instructional activity (the subject of instruction on the left side) and specific ecological arrangements in association with the student's academic behavior during that arrangement (displayed on the right of the Table).

Thus, for example, we can see that reading covered 36% of the observation (50 minutes). During all of reading the student's academic behavior was as follows: 10.7% writing, 4.3% silent reading, 1.7% academic talk, and .7% answering questions. The student's composite academic responding was 17.4% overall, the sum of the separate categories. These data constitute a molar description of reading and student behavior. A molecular analysis of eco-behavioral interaction is displayed within the center of the Table section devoted to reading. Here we see that the most frequent arrangement of stimlus events used by the teacher (32.3% of reading time) was R TSD SG AS T, (i.e., reading

Table 1

An Eco-Behavioral Analysis of a Student's Instructional Day

Arrangements						p(AI/An)	Student Academic Response					p(R/AI)		
Activity	AC	TA	ST	TP	TB		W	AGP	RA	RS	TA	ANQ	ASK	COMPOSITE
Reading	R	TSD	SG	AS	T	32.7	8.2				3.1	1.0		12.3
(36%)	R	TSD	SG	S	T	10.3								0.0
50 min.	R	LL	SG	AS	T	9.7								0.0
	R	WS	SG	AS	T	8.7	42.3			3.8				46.1
	R	WB	SG	AS	T	5.7	11.8			35.3				47.1
	R	PP	SG	AS	T	5.7	35.3							35.3
Reading	All (Baserate)					100.0	10.7			4.3	1.7	0.7		17.4
Math	M	PP	EG	S	T	32.2	44.6					1.8		46.4
(21%)	M	PP	EG	AS	T	8.6	46.7							46.7
29 min.	M	PP	EG	O	NR	8.0	35.7							35.7
	M	PP	EG	S	NR	6.3	45.5							45.5
	M	OM	EG	IF	T	13.2	13.0	4.3						17.3
	M	TSD	EG	IF	T	4.6	12.5							12.5
Math	All (Baserate)					100.0	33.3	4.0				0.6		37.9
Spelling	S	PP	EG	IF	T	36.1	46.2							46.2
(1%)	S	PP	EG	S	T	22.2	50.0							50.0
6 min.	S	PP	EG	B	T	19.4	71.4							71.4
	S	PP	EG	AS	T	19.4	0.0					14.3		14.3
Spelling	All (Baserate)					100.0	44.4					2.8		47.2
Language	L	PP	EG	AS	T	34.6	17.8				2.2			20.0
(16%)	L	PP	EG	AD	T	12.2	23.2				6.3			29.5
22 min.	L	PP	EG	AD	NR	7.7	28.9				10.0			38.9
	L	OM	EG	SG	T	13.1	13.1				5.9			19.0
Language	All (Baserate)					100.0	6.2				3.8			10.0

Soc/Study	SS TSD EG AS T	83.3		33.3		33.3
(7%)	SS TSD EG AS NR	13.0		42.9		42.9
9 min.	SS TSD EG AS D	1.9				0.0
	SS TSD EG AS OT	1.9				0.0
Soc/Study	All (Baserate)	100.00		33.3		33.3
Free/ Time (1%) 6 min.	FT RR EG AS T	47.1		12.5	18.8	31.3
	FT RR EG AS NR	29.4				0.0
	FT RR EG S OT	8.8				0.0
Free	All (Baserate)	100.0		8.8	8.8	17.6
Transition	TN FP EG IF OT	16.8				0.0
(13%)	TN FP EG AS T	14.0				0.0
18 min.	TN FP EG O NR	9.3			10.0	10.0
	TN FP EG AS OT	6.5				0.0
	TN FP SG AS T	9.3				0.0
Transition	All (Baserate)	100.0	4.7	0.9	0.9	6.5

Note. This table contains classroom ecology/student behavior interaction data for one student over one day at school based upon observation with the CISSAR Code (Stanley & Greenwood, 1981). The percentage occurrence of specific ecological arrangements is reported with response conditional probabilities (e.g., writing, reading aloud, composite, etc.). The arrangements and their percentage occurrence are found to the left in each panel, while the conditional probability values are found to the right. To make inspection of the Table clear, a number of conventions were used to organize the information within it. First, arrangements are organized within instructional activities. Second, the arrangements in each group have been sorted by task and structure variables to aid in the evaluation of different but somewhat similar arrangements. Thus, all paper/pencil, entire group arrangements are listed before the paper/pencil, small group arrangements, etc. Within the Table, comparisons can be made: (a) between arrangements within each activity, (b) between common arrangements occurring in different activities, and (d) between individual arrangements and the baserate for each activity.

Table abbreviations are as follows: Category Codes--Activities (AC): R = Reading, M = Math, S = Spelling, L = Language, SS = Social Studies, FT = Free Time, TN = Transition.

Task (TA): RR = Reader, PP = Paper/Pencil, TSD = Teacher-Student Discussion, WB = Workbook, WS = Worksheet, LL = Lecture, OM = Media, FP = Fetch/putaway. Structure (ST): EG = Entire Group, SG = Small Group, I = Individual. Teacher Position (TP): AS = Among Students, S = To the Side, AD = At Desk, IF = In Front, B = Behind, O = Out of Room. Teacher Behavior (TB): T = Teaching, NR = No Response, D = Disapproval, OT = Other Talk. Student Behavior Codes: W = Writing, AGP = Academic Game Play, RA = Read Aloud, RS = Read Silent, TA = Talk Academic, ANQ = Answer Question, ASK = Ask Question, AT = Attention.

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teacher + student discussion + small groups + teacher located among students + teacher engaged in teaching behavior). Student behavior during this single reading arrangement was 8.2% writing, 3.1% academic talk, 1.0% answering questions for a composite score of 12.3%.

These molar and molecular data allow one to ask and answer several types of questions about the student's instruction and behavior. First, (and most molar), the time devoted to separate subject matter over the day can be seen. Reading was taught during this observation for 36% of the time or 50 minutes. Spelling and Free Time occurred least at 1% or 6 minutes during the observation. Second, the student's academic behavior can be compared across activities. For example, spelling instruction resulted in the highest levels of academic behavior, 47.2%, while as one might predict, transition activities produced the least at 6.5%. It was also evident that major activities such as reading, 17.4%, and language, 10.0%, resulted in low levels of student academic behavior compared to math, 37.9%, spelling, 47.2%, and social studies, 33.3%. Third, (and most molecular of all), within activities one can examine the relationship of specific arrangements to student behavior. In reading, it was evident that the most used arrangements involving teacher-student discussion or lecture, (R TSD SG AS T, R TSD SG S T, and R LL SG AS T), were least related to academic behavior (12.3, 0.0, and 0.0, respectively). However, the remaining arrangements in which worksheet, workbook, or paper/pencil tasks were used resulted in composite scores ranging from 35.3 to 46.1%, two to four times higher. Thus, the molecular analysis of eco-behavioral interaction reveals information about the configuration of the instructional session and their behavioral relationships. It also suggests instructional changes, the reconfiguring of arrangements, which might be tested in order to increase student academic behavior. Facilitator arrangements, those with high behavior relationships (above 30% for example), might be used more often while the use of non-facilitating arrangements might be reduced or modified. Process assessment data such as this can be used as a feedback device for teachers interested in increasing student academic responding.

The Correlation Between Eco-Behavioral Interaction and Achievement

Between 1978 and 1981, our group at the Juniper Gardens Children's Project, reported a relationship between low reading achievement, low IQ, and fourth grade students daily levels of academic behavior (Greenwood, et al., 1981; Hall, Delquadri, Greenwood, & Thurston, 1982). This appeared at about the same time that other researchers were reporting a relationship between students' academic learning time or engaged time and their achievement (e.g., Rosenshine, 1979). What was significant about these data is that these researchers were basing their findings upon direct observation of what teachers and students did in the classroom, as opposed to what teacher's said they did or what teacher's schedules indicated would be done during classroom time (Brophy, 1979).

Our data suggested that low SES students, well known to be at risk for academic retardation, were being educated within classroom environments and instructional methods associated with lowered levels of academic responding (i.e., writing, academic play, reading aloud, reading silently, academic talk, asking questions, and answering questions,. This daily difference in composite academic behavior averaged 5% or about 11-13 minutes per day between Title 1 and non-Title 1 students (Stanley & Greenwood, 1981). The data in Table 2 illustrate this difference for both a fourth grade and a first grade sample.

Table 2

Percent of Day Spent in Academic Behavior by Groups

Group	Academic Behavior Codes								N
	W	AGP	RA	RS	TA	ANS	ASK	COMPOSITE	
Fourth Grade Sample (1980)									
Title 1	15.7	1.2	0.5	5.0	1.5	0.8	0.4	25.1	48
				*	*			*	
NTitle 1	17.2	1.3	0.6	8.2	2.3	0.7	0.3	30.6	45
First Grade Sample (1984)									
Chapter1	18.0	0.7	2.4	8.4	1.9	0.9	0.3	32.5	25
	*		*					*	
NChapter1	24.0	0.8	1.3	9.8	1.1	0.1	0.2	37.6	23

Table 2 Continues (pg. 2)

*p< .05

Note. Academic Behavior Abbreviations are: W = Writing, AGP = Academic Game Play, RA = Reading Aloud, RS = Reading Silent, TA = Talk Academic, ANS = Answer Question, ASK = Ask Question, N = Number of Students Observed. Group Abbreviations are: NTitle 1 = Non-Title 1, NChapter 1 = Non-Chapter 1. The Composite score is the sum of the seven code scores.

Furthermore, the range in academic behavior across individual students in inner-city schools was large, from 10 to 109 minutes spent in academic behavior per day. A secondary analysis of these data confirmed that students in the sample attending Title 1 schools (now Chapter 1) had fewer academic interactions in each of their major instructional activities during the day (i.e., reading, math, language, spelling, etc.). We also have recently replicated the fact that students may be well-behaved at school but not be actively engaged in academic behavior. These data are displayed in Table 3. Students' means for total appropriate behavior, which includes both academic and task management responses, are compared to students' composite academic responding. These data demonstrate that the correlation is not perfect. In both samples, some schools high in total appropriate behavior were not high in academic behavior (See for example, Welborn and Lindbergh).

Table 3

Appropriate Behavior vs. Academic Responding Summary by Schools

School		Appro. Behavior	Acad. Response		N
		M	M	Rank	Students
Fourth Grade (1980 Sample)					
Kennedy		90.4	31.7	1	78
Quindaro		90.2	26.2	3	65
Welborn		87.9	29.5	2	69
Banneker		81.6	23.6	4	59
Overall	M	87.5	27.8		
	SD	4.1	3.6		

Table 3 Continues (pg. 2)

First Grade (1983 Sample)					
Kennedy		94.8	41.9	1	11
Lindbergh		89.9	23.8	9	14
Parker		87.9	41.0	2	11
Eugene Ware		86.9	30.0	8	13
Chelsea		85.1	36.8	3	12
Fairfax		83.5	30.4	7	10
Quindaro		78.7	35.2	4	12
Hawthorne		73.1	33.1	6	12
White Church		69.5	33.8	5	12
Overall	M	83.3	33.7		107
	SD	12.3	11.0		

Note. These data are based upon the CISSAR code (Stanley & Greenwood, 1981). *Appropriate Behavior* is defined by the sum of twelve codes devoted to academic responding and task management. These are: (Writing, Academic Game Play, Reading Aloud, Reading Silent, Talk Academic, Ask Question, Answer Question, Attend, Raise Hand, Look for Materials, Move, and Play Appropriate). The *Academic Response* score is defined by the sum of the first seven behaviors just listed, Writing through Answer Question. Thus, the difference between these two composite scores is accounted for by the five task management codes, Attend through Play Appropriate.

Because our code was developed to broadly represent ecological factors in the observational record, in addition to student behavior, it became possible for us to also examine the contexts of instruction in which student behaviors occurred. This revealed that Title 1 teachers in comparison to non-Title 1 teachers, used more media, and more discussion, which were not highly related to students'active academic behavior (e.g., reading aloud or academic talk). Conversely, the non-Title 1 teachers used more reader, and paper/pencil tasks in their lessons which yielded a greater relationship with students' academic behavior (Greenwood, Delquadri, Stanley, Terry, & Hall, in press).

In subsequent experimental research using classwide peer tutoring in reading, spelling, mathematics, and vocabulary instruction, we have reported findings that have supported the earlier results based upon descriptive designs. Increased academic responding is related to increased academic outcomes. Compared to instructional methods often used by teachers (baseline phase), peer tutoring increased the presence of key stimuli during the session (i.e., readers, paper/pencil, worksheets,), increased active student responding (e.g., reading aloud, academic talk, writing), decreased task management responding (e.g., attending, looking for materials, raising hand), decreased competing student behaviors (e.g., looking around, disrupt, etc.), and increased gains on Friday tests and reading rate checks (Delquadri, Greenwood, Stretton, & Hall, 1983; Greenwood, Delquadri, & Hall, 1984; Greenwood, et al., in press).

Thus, not only can we point to wide variance in academic achievement, but also a related wide variation in students' academic behavior measured either as molar time spent engaged or in terms of specific academic responses, and in teachers' arrangement of the classroom environment during instruction. This variance has been noted across schools, classrooms, and individual students. However, this variance can be reduced and controlled with implementation of an effective instructional procedure. These data suggest that one causal variable with respect to student achievement will be each teacher's ability to generate high levels of academic responding within specific instructional activities and over the school day.

Implications for Instruction

I have now discussed the problem of academic delay, described process assessment based upon eco-behavioral interaction, and have argued a correlational and functional relationship between students' achievement and eco-behavioral variables at school. The next topics, then must be devoted to the implications for instruction. The relevant questions are: "What are the features of instructional methods required to reduce this variance in student achievement"? and "How can these variables be addressed within special education outcome research"?

Effective instructional methods. The research literature on teaching which has included process measurement tells us that instructional methods that: (a) provide frequent opportunities to respond, (b) insure that all students respond correctly, and (c) provide positive reinforcement for student responding are most effective in terms of traditional academic test measures (i.e., tests, grades, etc.). Given that these are the basic goals of any instructional method, the question then is "How do we implement these events within the classroom?" Certainly, other considerations are necessary for a sufficient analysis of instruction, (e.g., educational objectives for each lesson, task analysis, programming/sequencing of tasks, introducing/practicing/reviewing, etc.), but these, I would argue, are not as fundamental as the response opportunity variables. In other words, all students can realize achievement gains in any curriculum, given frequent opportunity to respond, correct responding, and positive reinforcement. To affect outcome measures, we will have to actively engage students in the academic behavior, rather than simply expose them to the academic material. Since students who spend their school time in unresponsive instruction will realize lower outcome gains over the same amount of time, as will students in responsive instruction, we must create instructional environments that produce high rates of academic responding for all students. We should also recognize that instructional procedures vary in their ability to create and maintain student responding. Thus, the selection of appropriate procedures will necessarily be based upon research. Procedures must also meet a reasonable criterion of efficiency in terms of teacher implementation. Procedures that work but are difficult or effortful to implement will not be maintained.

(i) Provision of Opportunity to Respond. In order to actively respond, students must be presented with a task stimulus and a teacher command stimulus occasioning their response. Both the form and rate of these opportunities are important to the rate of students' academic interactions. The common form of these opportunities are teachers' questions, task presentations, and/or commands to respond. In naturalistic instruction, these commands to individuals have been estimated to be as low as 1.40 per minute (Grinstead, 1982). We have also reported occasions when low reading groups, scheduled last, were not held at all due to extra time spent with more advanced reading groups. Obviously, students have no opportunity to learn in these ill managed circumstances. In Direct Instruction reading groups, where a frequent task presentation rate is emphasised, the opportunity rate has been estimated at 12.0 task presentations per minute (Carnine, 1976; Carnine & Silbert, 1979, p. 26). In Classwide Peer Tutoring methods, the rate that first grade tutors present new spelling words to the tutoring has averaged 6.0 per minute (Kohler, 1984).

The second form of opportunity is present when students use curriculum materials and the students typically determine their own task presentation rate. When the pace of task presentation and responding is self-managed there is obviously a wide variablity in rate and content coverage during a period of instruction. This variability can be reduced by individualizing materials or by using contingencies that reinforce higher rates of task completion. Timings, in which students complete as many items as possible with in several minutes, are another procedure for accelerating task presentation rate within curriculum materials.

(ii) All Students Respond. Instruction in which all students are required to respond, either to the same opportunities or to different opportunities, is more effective than those that allow variation in who responds. Instruction in which teachers lecture or discuss with students seldom requires all students to respond in an active way. Rather, individual students are called on or asked to volunteer a response. In Direct Instruction reading groups however, teachers require group responding to their response prompts. All children respond to the same prompt signal. Students who are late in responding, who hesitate, or who are wrong, are then drilled individually in order to ensure that they can emit the response. In Precision Teaching timings, all students start and stop at the same time. In Classwide Peer Tutoring, all students are simultaneously responding to individual task presentations of their tutors.

(iii) Positive Reinforcement. To the extent that students are provided reinforcing consequences for their academic behavior, the probability of their continuing to respond is increased. The social reinforcement that students receive in naturalisitic instruction is known to be very infrequent (White, 1975). It is also well-accepted that other forms of reinforcement (e.g., performance feedback, token reinforcement with backup consequences, etc.) also are used infrequently in naturalistic instruction. Moreover, the rules of reinforcer effectiveness in terms of immediacy, schedules, and avoidence of satiation are either unknown or simply not widely practiced by teachers.

Effective instruction takes full advantage of the positive reinforcement principle. Teachers in Direct Instruction praise contingent upon correct student response or for improved test scores. Point earning is used for tutee responding in Classwide Peer Tutoring, as are interdependent group-oriented contingencies, as is performance feedback through the posting of student's point totals and Friday test scores. Similar procedures are used in Precision Teaching to reinforce student gains in correct response rates.

Research Design in Special Education Outcome Research

Since the mission of special education is student change and growth, outcome research must focus directly upon student change. Outcome research must by definition be the study of dynamic and not static phenomena. Research of this type requires repeated assessments of outcome variables over time in order to examine gains or change from occasion 1 to occasion 2. Procedures that are effective producing gains are those needed by the field. Static research designs (e.g., posttest only designs, including most evaluation designs), are simply not able to provide precise information on child change before, during, and after treatment and are therefore, inappropriate for examining the causal effects of special education. Simillarly, designs based upon multiple regression models that interrelate variables assessed at one point in time will not qualify as a useful outcome research design. Designs involving experimental manipulations of special education variables (e.g., teaching variables), and including repeated measurement of student change over time are needed. Designs that meet these criteria include single-subject research designs (e.g., reversal, multiple baseline, or alternating treatment manipulations) and experimental-control group designs with repeated measures. Single-subject designs are particular useful for discovering functional relationships between special education treatments and outcome variables. Experimental-control group designs with repeated measures are useful in establishing the generality of these initial discoveries across units of the service delivery system (i.e., students, teachers, schools, districts).

Research that is particularly needed are studies that also combine repeated measurement of outcome with educational process variables (e.g., eco-behavioral interaction and student achievement). As previously discussed, the interpretation of attained outcomes is enhanced by the inclusion of process measures. While one may conclude in experimental outcome studies that the treatment was in fact causally related to gains in outcome variables, without process assessment, it is difficult to know little more. Why did the treatment work? Were the experimental variables implemented as planned or were they only partially implemented? What aspects of the treatment related to change in the outcome variables and which did not? Was student behavior in relation to the treatment as expected or otherwise? If there was no change in outcomes was it due to a treatment that apparently is not effective and should be discarded or was it due to a failure of the staff to implement as planned?

Within this framework of process-outcome research, investigators must continue to build into their investigations the means to account for special education as the independent variable. Eco-behavioral interaction is one means for doing this since specific variations of the instructional ecology can be expressed in terms of student behavior. This is a dynamic analysis since change in student behavior can be noted in relationship to change in instructional variables. This metholodolgy allows one to address questions concerning student behavior that transcend the well- established findings concerning student's levels of academic engagement and/or learning time. Future studies must examine the important topographies of student behavior in relationship to instruction with the intent of revealing the logic and sequence of these interactions, if we are to provide teachers with precision advice on how to teach most effectively.

Research must continue the search for effective instructional procedures. However, research is more urgently needed to identify the variables that account for teacher's implementation of effective classroom procedures. If increased opportunity to respond is related to increased student performance, what affects teacher use and generalization of this procedure over time? Given effective instructional variables with clear histories of outcome research support, what are the factors that ensure teacher selection and use of these procedures in the classroom? What are the factors that account for teachers drifting from established procedures and how can this be prevented or modified?

Similarly, outcome research must address questions concerning the effects of partial or incomplete implementation. Although teachers often seek to create new and interesting instructional procedures, they must also understand that variance in outcome performance is related to deviation from effective teaching procedures. Creativity must be channeled within the context of the use of effective standard practices if we are to ever approach the goal of equal outcomes for children in special education. As we continue the discovery of effective instructional procedures, discovery of the means to ensure quality implementation of those procedures will become the most pressing issue within special education outcome research.

Summary and Conclusions

This Chapter began with the supposition that the major preoccupation in special education with the identification and placement of students was in fact a direct result of a failure to develop a powerful, widely practiced technology of instruction. It was further argued that low academic achievement and variance in students rate of academic responding in the classroom setting is related to instructional practices and the daily production of student academic behavior. Will it ever be possible to provide students equal outcomes in special education? Research on teaching has revealed that instructional methods which: (a) provide frequent opportunities to respond, (b) allow all students to respond, and (c) provide reinforcing consequences for responding are most effective increasing student gains in academic outcome measures (e.g., tests, grades, etc.). The new generation of outcome research in special education must focus upon the assessment of student change in terms of both outcomes and instructional processes. This research will enable researchers to: (a) tease out the important ecological variables and stimulus arrangements related to optimal student performance during instruction, (b) precisely control and compare alternate instructional procedures, and (c) identify important factors in the implementation of effective instructional procedures. Research of this nature, based upon experimentation, will be important to the development of a powerful and widely practiced technology of instruction in special education.

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CHAPTER IV

ENVIRONMENTAL VARIABLES AFFECTING THE SCHOOL ACHIEVEMENT OF CULTURALLY AND LINGUISTICALLY DIFFERENT LEARNERS: AN INSTRUCTIONAL PERSPECTIVE

CARMEN ARREAGA-MAYER

Abstract

The literature offers many explanations for the differential educational attainment of culturally and linguistically different learners. However, research on effective methods is relatively scarce. This review of the literature was designed to examine the research basis for the school achievement of culturally and linguistically different learners from the standpoint of instructional effectiveness and the opportunity to learn. This review concentrated upon research which directly assessed specific ecological/instructional processes in relationship to achievement outcome measures. An important contribution of the present review is the focus upon functional ecological and teaching variables affecting the academic performance of culturally and linguistically different learners.

Introduction

Despite apparent gains in educational equity in America, especially in the past two decades, differential educational attainment remains between many minority and majority groups. This phenomena is also noted in other countries wherein the inequity remains greatest for refugees and children from cultures lacking modern school experiences (Rolider & Greenwood, 1982). Many reasons have been put forth to explain this pervasive and continuing inequity. Some researchers have viewed children from different cultural and linguistic backgrounds as inherently deficient and inferior, thus making a pessimistic appraisal of their chances of success in school even with curriculum reform (Miller, 1978). Other researchers have argued that differential success in school is best explained by differences in language, values, customs, attitudes, and norms which are characteristically associated with certain ethnic, racial, national origin, gender, and socioeconomic groupings (Dixon, 1977; Genova, 1981; Marjoribanks, 1974; Ramirez, 1974; Stodolsky & Lesser, 1967). Still another group of researchers has emphasized the effects of learning process variables on minority students' responding and academic achievement (Brophy, 1979; Brophy & Evertson, 1981; Greenwood, Delquadri, & Hall, 1984;

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Hall, Delquadri, Greenwood & Thurston, 1982; Harris, 1977; Henderson, 1969; Stanley & Greenwood, 1983; Trueba, Guthrie, & Au, 1981). Lavin's (1965) extensive review of the predictors of academic performance among students of varied cultural backgrounds concluded that child intelligence accounts for less than half of the variance in school achievement. This finding has been supported by many studies, including the research of Baral (1977), Genova (1981), Greenwood et al., (1981), Stallings (1977), and Walberg and Marjoribanks (1976). These findings highlight the importance of studying the environmental correlates of academic achievement: the ecological-behavioral variables in home and school environments.

Culturally and linguistically different learners include Puerto Rican Americans, American Indians, Mexican Americans, Black Americans, Portueguese Americans, Jewish Americans, Irish Americans, Asian Americans, and all the diverse racial, cultural, and linguistic groups that constitute the school population in the United States. However, a recent review of 178 studies investigating an ecological-instructional hypothesis of academic performance revealed that 90% of studies dealt with Black and Mexican American populations (Arreaga-Mayer, 1984).

The aim of this paper is to identify those variables that are relevant to the academic learning of culturally and linguistically different students, with a major emphasis upon the Black and Mexican American students. This review covers investigations of the ecological-behavioral variables in home and school environments. Following discussion of research examining these two areas, recommendations and implications for future research are presented.

Ecological-Behavioral Variables

Gordon (1976) criticized research completed before 1976 for routinely focusing upon broad demographic variables as the environmental basis of student's academic ability and performance. According to Gordon, educational research has been tied to the loosely defined notions of ethnicity, socioeconomic status, language, gender, geographic origin, and level of socialization. It seems reasonable to conclude that as widely represented as these indicators (demographic categories) are in the literature, they are too vague and ambiguous to be the functional determinants of achievement (Coleman et al., 1966; Lavin, 1965; Ornstein, 1982; Weinberg, 1977). What is missing in this literature are direct studies within home and classroom environments of multicultural children that empirically assess the learning process; variables that are the putative causes or limiting factors upon child achievement at school.

Delquadri (1978), in a comprehensive review of 51 reading-learning studies, noted that over 50% of the participants in these studies had been described as "minority" children. He reported, in comparison to children from the dominant culture, that "minority" children displayed identical learning patterns on many learning tasks which were represented in those studies. Under structured learning conditions, minority children learned in the same manner as their majority group peers in terms of response frequency, the slope of the learning curves, learning trials, use of discriminative stimuli, and reinforcement procedures. Yet, research indicates that minority group children from low socioeconomic backgrounds frequently enter school at kindergarten or first grade with significantly fewer academic skills based upon standardized tests (e.g., Leinhart, 1980). Similar lower performance findings have been noted at later grades, even after children have been within the school program for several years (Becker, 1977). In fact, low socioeconomic and minority group students have not been expected to perform higher than the 20th percentile on academic tests throughout their school years. Additionally, minority group students have been overrepresented in special education programs for the retarded (Dunn, (1968) and learning disabled (Maheady, Towne, Algozzine, Mercer, & Ysseldyke, 1983). What is the environmental basis and what may be the solution for this phenomena?

Research on home environmental variables. Dave (1963) and Wolf (1964, 1966) demonstrated that home environmental variables, focusing on behaviorally defined events in the natural environment, displayed substantial relationships to concurrent measures of intelligence and academic achievement. Their work focused on what parents actually did in their interactions with their children at home, rather than what parents were in terms of status level, source of income, type of dwelling, or some other demographic variable. The environmental variables identified by the authors as likely to relate to academic achievement were: (a) the climate created for achievement motivation (e.g., parental asperations for the child's education, the rewards accorded academic accomplishments, etc.); (b) opportunities provided for verbal development; (c) nature and amount of assistance provided in overcoming academic difficulties; (d) the activity of significant individuals in environment; (e) level of intellectuality in the environment; and (f) kind of work habits expected of the individual. Environmental varibales identified as likely to be related to general intelligence were: (a) stimulation provided for intellectual growth; (b) opportunities provided for, and emphasis on, verbal development; and (c) provisions for general types of learning in a variety of situations. Their instruments included a focused interview schedule and rating scales which were intended to define and measure variables selected from the literature in learning, child development, and and related areas. In the later study (Wolf, 1966), the correlation between the directly observed home environment rating and school achievement was +.80, indicating that measures of what parents do with their children can relate highly to the child's academic success in school.

Henderson and colleagues conducted a series of studies to evaluate the predictive and concurrent validity of home environmental variables with respect to the academic performance of low achieving minority group children (Henderson, 1966, 1969;

Henderson & Merritt, 1968; Valencia, Henderson, & Rankin, 1981). For example, Henderson and Merritt (1968) and Henderson (1969) used nine directly assessed environmental variables (i.e., achievement press, language models, academic guidance, activeness of family, intellectuality of the home, work habits, identification with models, range of social interaction, and perception of practical value education), to predict the academic achievement of six year old Mexican American children from an economically depressed area. The children were divided into high and low contrast groups based upon measures believed to predict school performance (i.e., Goodenough-Harris Drawing Test and Van Alstyne Picture Vocabulary Test). These findings demonstrated that children in the high potential group came from home environments and family backgrounds that offered a greater variety of stimulating experiences than were available to those children in the low potential group.

Matuszek and Haskin (1978) conducted a parental survey of a sample of 533 parents of Anglo, Black, and Mexican Americans in Austin, Texas. Their highest correlation was located between the variable of student reading in the home and academic achievement at the fifth grade level. While it cannot be inferred from these correlational data that a child who reads more at home will then improve his reading achievement, these data do suggest a possible focus for experimentation with specific instructional intervention and parental involvement programs.

Valencia, Henderson, and Rankin (1981) studied the relationship of 13 family constellation and sociocultural variables (i.e., age of child, sex of child, number of children, birth order, language of test, father present, schooling of father, schooling of mother, country of mother's schooling, country of father's schooling, language of the home, social position score, and social class level), to the intellectual performance of 190 Mexican American preschool children from low income families. They concluded that the most academically competent children were those who came from homes in which: (a) the dominant language was English, (b) who were tested in English rather than Spanish, (c) whose parents were educated in the United States rather than Mexico, and (d) whose parents had attained the highest levels of formal education among those represented in the sample. The authors further stated that the effects of schooling are very important, and that skills and concepts implicit in the school culture are passed on by parents to their children. The assessment and analysis of this actual process, however, (e.g., the functional effects of parents educated in Mexico upon students learning at home), remains a major challenge for future research.

Another group of researchers pursuing various issues related to family interaction have directly assessed naturally occurring home processes using direct observational coding systems (Hart, 1983; Patterson, 1982; Wahler, Berland, Coe, & Leske, 1977). These researchers have established clear relationships between language development and family interaction variables (Hart, 1983), aggressive child behavior and family interaction (Patterson, 1983), and mother's depression as a function of home interaction (Wahler, et al., 1977). These approaches, based upon an eco-behavioral interaction perspective, expand the focus of assessment to account for the interactions occurring between individuals within and outside of the home setting. For example, Wahler et al., (1977) discussed learning as the product of a system in which behaviors are determined by ecological subsystems. At the first level is the covarying system of behaviors within a child's repertoire of responses. At the second level is the interacting behavior system of the child's primary group, such as the family. At the third level, the family subsystem serves as a component of the community systems, such as the school. This system model and its relevant data directly assessed, describes the functional interrelationships among the child's behaviors, those of family members, and those of the school in terms of correlations among them in their day-to-day occurrence. This approach however, has yet to be applied to the evaluation of educational programs for culturally and linguistically different learners.

Studies have shown that children learn language and academic skills (e.g., reading), through both incidental and formal teaching interactions with their parents and/or older siblings. For example, parents may engage in informal tutoring by asking questions or having the children identify letters or words in a story while reading to them. Becker (1977) reported that language, including specific vocabulary, is learned within the informal context of family interaction. Thus, the language spoken at home and the level of vocabulary used can be expected to exert a powerful ceiling influence upon child language skills and development.

In formal studies of home instruction, Thurston (cited in Hall, Delquadri, Greenwood, & Thurston, 1982) reported an experimental study in which a Black mother was trained to tutor her student reading sight words. The student was tested on these items by the teacher at school. Results indicated that child increased her mastery of the content due to tutoring at home, while during reversal conditions (in the absence of home tutoring), she made little progress. Delquadri, Whorton, Elliott, & Greenwood, 1983 cited in Greenwood, Delquadri, & Hall, 1984 trained 19 inner-city Black parents to tutor their children in oral reading at home using a ten minute procedure involving practice and a modeling error correction procedure. When these children were assessed at school by the teacher these students increased their rates of correctly read words from 60 correct words per minute before parent tutoring to 70 during the tutoring program. Reading errors were cut in half, from 3.0 per minute prior to the program to 1.5 per minute during the program. Similar findings were reported by Wedel & Fowler, 1984, with a student for whom English was a second language. This student mastered 26 sight words in 14 weeks as a result of the parent pointing to a word in a reader and asking the child to read it. When correct, the parent confirmed the response by saying "yes, that is correct" and praising the child occasionally for getting it right. If the child was incorrect the parent modeled the correct pronounciation, then asked the child to say it. These studies are but a few of the experimental studies in which parent tutoring at home has been functionally related to improved student academic performance at school.

In summary, the research reviewed in this section has revealed important information concerning environmental processes and methods of assessment necessary to the functional study of the academic development of minority group children in the home setting. Compared to prior studies of poorly defined demographic variables, these studies directly measured and/or manipulated ecological variables (e.g., instructional interactions) within the home setting. Moreover, the inclusion of specific ecological variables within the designs of some of these studies (e.g., Valencia, et al., 1981) helped to more clearly identify the environmental variables associated with student's academic performance and ability. In the case of the home tutoring studies, experimental designs were used and functional relationships were established. These studies, taken collectively, suggest that an observational analysis of ecological process variables and their function is needed to really understand the operation of a home environment on school learning.

The research discussed in this section clearly brings the traditional research (e.g., Coleman et al., 1966; Fink, 1962; Hernandez, 1973; Ornstein, 1982; Weinberg, 1977), based upon broad demographic variables, such as socioeconomic status, parental educational level, aspirations, and emphasis on education, etc. into serious question. This research also brings the field a giant step towards the empirical validation of important causal relationships and a technology of effective interventions.

Research on School Instructional Variables

Typically, achievement studies in the United States have not considered the opportunity to learn within the classroom setting as an achievement factor. Weinberg (1977) stated that the assumption in past achievement research with minority students has been that all learning is created equal.

> "Variations of teacher quality, differential opportunities arising from other school functions, and the duration of the school day and the school year are all of possible significance in conditioning achievement (p. 88)",

but have not been typically accounted for in the literature. Hall and his colleagues, (Greenwood, Delquadri, & Hall, 1984), however, have focused upon what they call the opportunity to respond during instruction. Their work has demonstrated that students, and classes vary in the opportunities presented by the teacher and the lesson, which have a powerful effect upon the amount and quality of student academic responding during instruction. They defined opportunity to respond as an interaction between the stimulus dimensions of the lesson (e.g., teacher, curricula, and method), and student behavior.

The lack of information on learning opportunity as environment-student behavior interaction has been widely recognized in education (Brophy, 1979; Dunkin & Biddle, 1974; Hoge & Luce, 1979), psychology (Barker, 1968; Bronfenbrenner, 1979), and behavioral analysis (Bijou, 1978; Foster & Cone, 1980; Patterson, 1979; Rogers-Warren & Warren, 1977; Wahler & Graves, 1983). Yet, there have been relatively few empirical studies of eco-behavioral events (i.e., environment-behavior interactions) that have applied experimental design to eco-behavioral hypotheses of learning and even fewer have addressed the cultural and linguistically different population. These studies require direct assessment of ecological events, student behavior, and the conjunction and sequence of these events over time.

Dunkin and Biddle (1974), Borich (1977), Brophy (1979), and Foster and Cone (1980), have all presented the case for the study of the effects of instructional interventions above and beyond well-controlled contextual conditions of past experimental studies, in order to better understand how classrooms and instructional procedures contribute to achievement and socialization. These researchers emphasize the need for examination of instructional practices within the framework of behavior change studies. Only then, it seems, will it be possible to design classrooms that maximize academic achievement gains over time.

Eco-behavioral Research. With the advent of recent improvements in observational systems and design methodology, researchers are beginning to establish clear relationships between classroom ecological variables (e.g., teacher behaviors, commands or instructions, materials used, tasks, etc.), and student outcomes (e.g., improved academic achievement scores). For example, Trueba, Guthrie, and Au (1981) demonstrated that the dramatic progress shown by students in programs that recognize their linguistic and cultural differences is not the result of changes in materials or curriculum, but stems from complex and subtle changes in the teacher-student relationship, in the organization of instructional tasks, and in the role students play as primary agents of their learning.

Rosenshine's review (Rosenshine, 1977) disclosed some of the instructional processes found to be positively and significantly related to student school achievement. These were:

1. Observed time spent directly on instruction as opposed to non-academic activities (Stallings, & Kaskowitz, 1974).

2. Student attention or on-task behavior as opposed to disruptive off-task behavior (Brophy, Evertson, 1974; Stallings,

& Kaskowitz, 1974).

3. Frequency of direct factual single answer questions posed by teachers instead of complex divergent questions (Brophy & Evertson, 1974; Soar, 1973; Stallings & Kaskowitz, 1974).

4. Student involvement in large group instruction rather than unsupervised independent study (Soar, 1973; Stallings & Kaskowitz, 1974).

Similar research focusing on students' learning interactions during classroom instruction and their effect on academic achievement have been conducted by Hall, Delquadri, Greenwood, and Thurston (1982). Their work has been directed at comparing instructional arrangements (i.e., process or contextual variables) in inner-city classrooms with those in suburban schools serving minority students and the students' responses associated with these particular instructional arrangements. They have developed a comprehensive classroom observation system, the Code for Instructional Structure and Student Academic Response (CISSAR) to sample sequentially the ecology of instruction; that is, activities (the subject of instruction); curriculum task type; structure (grouping); teacher position with respect to target student, and teacher behavior; and the student's behavior (Stanley & Greenwood, 1981).

Among their findings based on an eco-behavioral perspective, were the following:

1. Inner-city minority group students emitted significantly less active academic responding than suburban students even when IQ and socioeconomic status were statistically controlled (Greenwood, Stanley, Delquadri, & Hall, 1981).

2. While 74% of the day in inner-city classrooms was devoted to academic subjects, only 25% of the day was spent in active academic responding (i.e., writing, talking, reading, asking or answer questions, or reciting). The majority of the classroom day (45%) was devoted to passive attention (Hall, Delquadri, Greenwood, & Thurston, 1982).

3. Instructional arrangements were different in inner-city and suburban schools. In inner-city schools, teachers were more likely to assign seatwork and allow students to work independently (Greewood, Delquadri, & Hall, 1982; Stanley, & Greenwood, 1981).

4. Specific instructional arrangements were found to be most related to academic responding (e.g., generally those coded as including paper-pencil or reader tasks); others were found to be least related (usually those that included teacher-student discussion (Greenwood, Delquadri, Stanley, Terry, & Hall, 1982).

5. Academic responding was significantly correlated to reading and mathematics achievement. Of all response categories

on the CISSAR code, academic behavior was most related to student achievement (Greenwood, Delquadri, & Hall, 1982).

6. Effects of intervention changes in instructional contexts, and student responding, co-vary with achievement gains (Delquadri, Greenwood, Stretton, & Hall, 1983; Greenwood, Delquadri, & Hall, 1984; Greenwood, Dinwiddie, et al., in press).

These researchers have demonstrated that an eco-behavioral interaction approach (i.e., process-outcome approach) can tease out the ways instructional variables affect students' academic behavior and achievement, independently of socioeconomic level or minority group status. This eco-behavioral research paradigm is providing some practical answers regarding which classroom instructional variables critical to promote more effective teaching interventions for all children, and especially for the culturally and linguistically different learner.

Effective Instructional Models

The bilingual-bicultural intervention efficacy literature that currently exist is mostly characterized by studies focusing upon child outcome data (e.g., changes in IQ, achievement gains) as indicators of program success. There is a paucity of literature on effective alternative instructional strategies that can be used with minority students at risk for academic failure (process data). Unfortunately when thinking of multi-cultural education, the difficulties associated with non- or limited-English speaker tend to surface or many of the variables on which we have traditionally blamed the under achievement of minority students such as race, working mothers, SES, and single-parent families tend to be put forth as explanations. The problems that minority culture children face in schools are by no means simple (Phillips, 1983; Spindler, 1982). The complexity of these problems demands a closer look, a more molecular analysis of contributing factors in the child's school environment to academic achievement. This approach, however, has seldom been used in the evaluation of instructional program for culturally and linguistically different learners (Maheady, Towne, Algozzine, Mercer, & Ysseldyke, 1983).

The instructional strategies and techniques that have proven a greater impact on student achievement outcome include: Direct Instruction; Classwide Peer Tutoring; Precision Teaching; and Personalized System of Instruction.

Direct Instruction. The most powerful demonstration to date that instructional practices lead to powerful gains in students' academic outcomes, including those of culturally and linguistically different populations, was made by Direct Instruction (DI) in the Follow Through program evaluations and in recent follow-up studies (Becker, 1977, 1978; Becker, & Gersten, 1982; Stallings, 1975, 1977). The features of the DI programs included scripted and field tested lessons for teachers (instructional quality control), task analysis and programming of instruction, unit mastery, error correction, practice and group responding, signals for student response, small group instruction with emphasis on oral communication, and use of positive reinforcement.

The evaluation of DI included eight thousand low-income students from 20 communities across the United States. The sample included rural and inner-city Blacks, rural Whites, Spanish Americans in New Mexico, Mexican Americans in Texas, American Indians in South Dakota and North Carolina, and other students from a variety of ethnically mixed communities. The students received DI for three years. Results for the DI group indicated that these children at risk for low academic achievement (low income, disadvantaged and culturally-linguistically diverse children), who scored at the 18th percentile in reading at grade 1, were found to be at the 63rd percentile on the third grade reading achievement posttest. In grade equivalents, these students were more than one year above the national norms. Similar results were found for DI in mathematics (from 19th percentile to 54th percentile). A recent follow-up study of this population by Becker and Gersten (1982), at the fifth and sixth grades where they are receiving traditional instruction, indicated that these sizable benefits from the earlier interventions were maintaining. On reading achievement, these students were still above the 50th percentile relative to test norms. Major findings from the independent Follow Through programs evaluations, have been that a specific educational procedure (DI), was demonstrated to (a) contribute as much or more to the variance in student's academic achievement, as did their entering IQ scores and (b) that DI resulted in more time devoted to instruction (Stallings, 1975, 1977). Rosenshine (1977, 1979), and Rosenshine and Berliner (1978), explained these results as a function of: (a) regular exposure to instruction, and (b) increased student engagement with the academic task or academic learning time. Becker (1977, 1978), Englemann, Grazin, and Severson (1979), and Gersten, Carnine, and White (1984) also offered the specifics of the DI methods as the most important factors accounting for the Follow Through students' achievement gains (e.g., progammed lessons, signals to respond, etc.).

Duran (1980) studied the effects of DI in the teaching 117 first grade bilingual Hispanic children to read. The students came from two rural schools in the Southwest near the Mexican border. Both schools employed bilingual educational programs. The experimental manipulation consisted of teaching reading for one hour per day for eight consecutive weeks in each school, using either the DI method of bilingual education developed by the author, or the regular bilingual method already in effect in the schools. The author concluded that: (a) instruction based on the principles of DI can improve beginning bilingual children's achievement significantly more than that of regular bilingual instruction, and (b) that curriculum materials can be developed to teach reading to disadvantaged Hispanic children based upon DI. Results of this investigation provide further support to previous DI studies in which DI clearly takes advantageous use of instruction time and frequent practice opportunity to effect academic achievement gains.

Classwide Peer Tutoring. A second instructional procedure that enhances active responding and achievement gain in minority group, inner-city students is Classwide Peer Tutoring (Delquadri, Whorton, Elliott, Greenwood, & Hall, 1981; Greenwood, Delquadri, & Hall, (1982). Delquadri, Whorton, et al., (1981) devised a classwide peer tutoring program whereby entire classrooms are divided into tutoring dyads. The tutoring pairs alternate tutor and tutee roles for 10 minutes each on a daily basis. Tutors are required to: (a) monitor ongoing tutee responses, (b) identify and correct errors, and (c) give points for correct performance. The teacher monitors the classwide process, answers tutees questions, and awards points to tutors for correct tutoring. Additional features of the classwide peer tutoring program include: (a) weekly competing teams, (b) public posting of game point charts, (c) modeling error correction procedure, and (d) teacher assessment of individual student progress on a weekly basis (Greenwood, Delquadri, & Hall, 1984).

The classwide peer tutoring program, in contrast to traditional forms of tutoring is a system that allows all students in a classroom the opportunity for sustained practice on a task for 10 minutes each day. Procedures have been reported for oral reading (Delquadri et al., 1981), spelling (Delquadri et al., 1983), and sight words (Heron, Heward, & Cooke, in press). Delquadri, Whorton Elliott, Greenwood, (1983) conducted a study involving a total of 65 students attending inner-city schools. fifty-two percent of the students belonged to minority groups and all attended grades three through six. Four teachers and twenty parents also participated in the study. The students were assigned randomly to four groups based initially upon standardized reading test scores. The experimental school group received the classwide peer tutoring procedure for oral reading. The experimental home group received treatment at home, as their parents or an older family member was taught to use a home tutoring procedure (Whorton et al., 1982). The control and average peer groups received only the regular instructional program at school and no home instruction. Following three months of school and home interventions in the two experimental groups, results indicated that both home and school tutoring groups achieved statistically lower error rates during their passage reading to the teacher. The two experimental groups also read with significantly fewer errors than did either the average peer or control groups, dramatically increasing their reading fluency. Delquadri, Greenwood et al., (1983) assessed the effects of classwide peer tutoring on the weekly spelling test scores in a third grade classroom consisting of six learning disabled (LD) children and 18 average peers. The participating school was located in an inner-city, low income, minority neighborhood. Three of the children were at or above the national average for spelling achievement on the Metropolitan Achievement Test. The remainder were below national norms with six (LD) displaing a beginning first grade level of achievement.

Results of this study demonstrated that the class-wide peer tutoring technique dramatically improved spelling performance, particularly by the lower functioning children (from 9.0 errors at baseline to only 2.5 during tutoring). These lower error rates were equal to the levels being achieved by the average peers during baseline. The individual data for the "low achievers" showed a dramatic increase in perfect scores (100%) on Friday spelling tests when compared to baseline condition (from a range of 8.0 -11.0 errors to .5 - 3.5 during first phase of tutoring, up to 6.0 - 15.0 during second baseline, to a range of 0 - 3.0 during the last tutoring phase). The average peers also benefited from the spelling tutoring game (from 3.0 errors per week before to .5 errors during tutoring).

In summary, these researchers demonstrated that, academic responding can be contextually controlled, that the arrangement of this control via instructional design (e.g., classwide or home tutoring) are of prime importance to the educational gains of the children, and that increased opportunity to respond is one causal component of academic achievement.

Personalized System of Instruction. Personalized System of Instruction (Keller, 1968) is a procedure for engineering personalized instruction in the classroom. It is an alternative instructional procedure that can be effectively implemented across a broad range of academic skills, instructional materials, and settings. It has most commonly been used at the level of university teaching but has also been used with students at lower grade levels (Kirigin, Braukman, Atwater, & Wolf, 1982). Keller (1968, pp. 83) summarized features which distinguished PSI from conventional teaching procedures as follows:

1. Self-pace feature (Born & Herbert, 1971; Fawcett & Fletcher, 1977).

2. Unit - perfection requirements for advance on the material (Bitgood & Seagrave, 1975; Born & Herbert, 1971; Fawcett & Fletcher, 1977).

3. Stress upon the written word in teacher/student commnunications (Semb, 1974; Williams & Lawrence, 1975).

4. Use of lectures and demonstrations as vehicles of motivation (Keller, 1968).

5. The use of proctors (a student chosen to serve as teaching staff), which permits repeated testing, immediate scoring, tutoring, and a marked enhancement of the personal-social aspect of the educational process (Bostow & Blumenfeld, 1972; Kirigin, et al., 1982).

Keller stresses as especially important, in a course taught by such methods, that any differences in social, economic, cultural, and ethnic backgrounds are completely subordinated to a friendly intellectual relationship between two human beings (student-proctor) through the period of the course. Studies comparing PSI to traditional lecture methods of instruction have demonstrated increased grade point averages and test performance with PSI (Hess, 1977; McMichael & Corey, 1969; Schimpfhauser & Richardson, 1977; Sheppard & MacDermot, 1970).

Precision Teaching. Precision Teaching (Beck, 1979, White & Liberty, 1976), is a set of measurement procedures to assist and guide educational decision makers in making better instructional decisions. Unlike the previously discussed educational procedures, Precision Teaching (PT) is not a method of instruction in the sense that it does not specify instructional procedures. However, it is a means for powerfully assessing the progress children make attaining instructional goals via what ever instructional methods are used.

Precision Teaching equips the classroom teacher with: (a) precise, direct, and daily measures describing student academic performance, (b) daily accuracy and error rates, (c) formative educational decision from charted data; and (d) a bank of practice sheets designed to assess student performance upon standard classroom curriculum objectives. In conclusion, although PT is not a complete teaching method per se, it shares many of the characteristics of the effective instructional procedures previously discussed in this section. First, the need for direct measurement of student academic performance. Second, high performance standards (accuracy and spelling). Third, the need for frequent, intense student practice sessions. A fine example of PT application and outcome data is the chapter by Lovitt, 1976.

In summary, the successof the four instructional strategies previously discussed rests on the molecular analysis and manipulation of contributing factors in the students' school environment to academic achievement (i.e., eco-behavioral analyses).

Discussion

This article has reviewed the environmental basis for the school learning of culturally and linguistically different children. Much of the traditional literature in this area has been devoted to the use of indirect and molar measures of the environment (e.g., socioeconomic status, ethnic-culture background, etc.). Moreover, these studies often treat these measures as unitary and homogeneous, when in fact the events that transpire in one's life that impact school learning (one's history) are neither unitary or homogeneous in nature.

Most promising, is the identification and empirical validation of classroom teaching variables (ecological variables or process variables) by a variety of investigators as important causal factors affecting the academic performance of students. As evident in the literature, achievement can be negatively effected when: (a) the opportunity to learn and time on-task is low, and (b) when the structure of the instructional program is not oriented toward monitoring, controlling, and coordinating the amounts of active academic responding for culturally and linguistically different learners.

Some recent research has improved the measures used for evaluating home and school environments. The use of direct assessments of the environment in interviews, ratings, and observations is offering a new look at both the quality and frequency of interactions students have in relationship to their academic development. As long as we continue to treat instructional procedures as a singular entity and disregard the complex array of contextual variables that control the occurrence and topography of learning behaviors in natural environments (i.e., home and school), we will continue to merely "expose" students to the curriculum and all students will fail to learn. Hence the need not only for an eco-behavioral method of analysing the interactions that occur in homes and classrooms for culturally and linguistically different learners, but also for a method for recording its pragmatic consequences, its actual effects on the learner.

In conclusion, the eco-behavioral approach to research (process-product) equips the education of the culturally and linguistically different learner with new dimensions and methodological alternatives as means of guiding educational reform. It can provide a fine-grain analysis of what is going on in the lives of the culturally different learner and how these experiences affect academic achievement. Thus, program outcome can be evaluated in terms of the instructional procedure received. Because the findings of eco-behavioral are concrete (e.g., CISSAR data previously described), not abstract, they can motivate educators and communities to act in ways that make a difference.

It appears that potentially effective alternatives to current educational practices are available for consideration and development as researchers assist school districts move toward the improvement of the programs. Culturally and linguistically different learners will succeed only to the extent that the instructional technology implemented with students remains the fundamental factor in education services.

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CHAPTER V

ECO-BEHAVIORAL ASSESSMENT: A METHODOLOGY FOR EXPANDING THE EVALUATION OF EARLY INTERVENTION PROGRAMS

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Abstract

The effectiveness of early intervention programs has been an area of controversy since the early 1960's. Unfortunately, many in the academic community and the general public remain unconvinced that spending government funds for the education of young handicapped children is an effective use of public resources. Research on this effectiveness issue has been limited to the measurement of singular outcomes (e.g., changes in the behavior and/or adjustment of the handicapped students or parents that have been the targets of intervention). This paper proposes a methodological expansion in evaluation research, an eco-behavioral approach, that has been used recently in teacher effectiveness studies within elementary grade classrooms. The paper discusses the implications of adding the eco-behavioral approach to the evaluation of preschool programs for the handicapped. It argues that this methodology will allow both (a) determination of early intervention effectiveness and (b) specification of factors that are responsible for this effectiveness.

Introduction

For almost twenty years, the effectiveness of early intervention programs has been the subject of public and academic debate. Does educational intervention in the lives of young children with special learning problems produce important and lasting gains? From the inception of programs for disadvantaged preschoolers in the early 1960's, to the more recent establishment of educational services for preschoolers with handicapping conditions, researchers have sought empirical answers to this question.

Although many of the earliest studies reported no effect of early childhood programs (Cicirelli, 1969; Bronfenbrenner, 1975), the most recent and convincing research studies indicate that early intervention programs are successful in producing lasting gains in the development of disadvantaged and handicapped children (Lazar & Darlington, 1979, Schweinhart & Weikart, 1981; Stock et al., 1976).

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Parameters of the Current Efficacy Literature

The early intervention efficacy literature that currently exists focuses almost exclusively upon child outcome data. Review of the literature indicates that a variety of outcome measures have been employed as indicators of the effectiveness of early intervention programs. As indicated in Table 4, by far the most common outcome variable used in this research has been criterion-referenced tests. Criterion-referenced measures are useful for evaluating preschools because they serve two purposes: they point to gains made by participants on tests of preschool skills, and they assist program managers identify skill deficiencies and specifying behavioral goals for intervention (Bricker & Dow, 1980).

Table 4

Outcome Measures Employed In Past Efficacy Research On Early Intervention

Outcome Measures	Number of Studies Employing Measure	Percent of Studies Employing Measure
Number of Skills Acquired as Measured by Criterion-Referenced Tests	21	70
Improvement on Norm Referenced Tests	9	30
Measures of Transitions into Subsequent School Environments	9	30
Social Competancy Measures	8	27
Children's Attitudes and Values	4	13
Changes in Parents' Behaviors and Attitudes	4	13
Total	55	183

A second class of outcome variables is improvement or change in developmental quotients derived from norm-referenced instruments of intelligence. An individual's quotient measured at two points in time is often compared to the rate of change expected in the non-handicapped population as indicated by test norms. These types of measures are useful because they allow comparison of mild to moderately handicapped program participants "against a set of developmental expectations generated from the performance of a substantial number of normal children" (Kopp, 1979, p. 35).

A third class focuses upon participants' successful transitions to school environments subsequent to preschool. A variety of these indicators have been used to measure program graduates' success in adapting to the elementary school setting. The most prominent among these include whether or not the program graduate was placed in a regular education classroom, whether or not the child was academically retained, and whether or not the child required special services (Karnes, Schwedel, Lewis, Ratts, & Esry, 1981; Lazar, Darlington, Murray, Royce, & Snipper, 1982; Schweinhart & Weikart, 1981). Programs using such measures provide evaluation data that parents, administrators, policymakers, and the scientific community can all understand. More important, however, they indicate whether or not a program has met one of its foremost goals: to enhance its participants' probability of success in the compulsory education system (Takanishi & Feshback, 1982).

A fourth class of outcome measures is improvement in children's social competence or behavioral adjustment. These measures vary in both content and instrumentation. They range, for example, from ratings by teachers and parents of children's problem behaviors (Strain, 1981); to direct observation of social and nonsocial behaviors towards adults and peers (Greenwood, Todd, Hops, & Walker, 1982); to self-reports of delinquent behavior in long term follow-up studies (Schweinhart & Weikart, 1981). These measures have more relevance to social adaptation than do norm-referenced measures such as IQ tests (Zigler & Balla, 1982).

A fifth class is motivational, emotional, and self-concept measures. A number of authors have argued the importance of including attitude variables because these variables may modify the effects of a child's educational environment in either a positive or negative direction (Bell, 1968; Sameroff, 1975). The advantage of including measures of attitude and values when evaluating early intervention programs is that they sample an important domain and may relate to other outcome measures.

The sixth class of outcome measures is assessments of parents' behavior and attitudes as a result of early intervention. Parent measures provide an important indication of whether training activities directed at them have been successful. Additionally, changes are sometimes noted in parental behaviors when parents were not themselves targets of the intervention procedures (Gray, 1977).

The Problem with Current Evaluation Research

Evident in the literature reviewed were six general classes of outcome measures which have been used to evaluate the effectivensss of early intervention programs. While these measures have been useful in documenting that important changes have occurred in the lives of children who have been involved in early intervention programs, they have provided little information regarding why those changes have occurred. This is because the entire focus of assessment in these early intervention studies has been upon child-centered outcomes, the dependent variables. Little, if any, attention has been paid to the independent variable, the preschool treatment that has been provided. Past evaluation studies have treated preschool interventions as unitary variables that were either "on" or "off". There has been little specification and little assessment of the many components that differentiate one program from another such as: the behaviors engaged in by the teacher, the objectives taught, and the manner in which objectives were implemented as instruction. Past evaluation studies have treated early interventions as singular entities and have disregarded the complex array of dynamic variables that determine program outcomes on a day-by-day and even moment-by-moment basis.

The knowledge that a program has brought about increases in participants' skills or improvement in IQ scores or successful transitions for its graduates into the elementary grades, may indicate that the program was successful. However, this design provides no information about the specific components that made the program successful. The science of early intervention service delivery can only move forward when successful programs can be replicated, and those programs can only be replicated when the independent variables have been clearly delineated, assessed, and experimentally examined (Sidman, 1960; Strain & Kerr, 1981). A new set of controlled efficacy studies must be undertaken to examine the specific programmatic factors responsible for the positive outcomes resulting from early intervention.

Forerunners of the Eco-Behavioral Approach

An eco-behavioral approach to program evaluation is a means of assessing program variables through systematic observation and measuring the moment-to-moment effects of an array of variables upon student behavior. The momentary interactions between immediate program variables as ecological stimuli and student behaviors are the units of analysis for predicting or otherwise investigating program outcomes (e.g., developmental gain or long-term achievement). Thus, this approach differs dramatically from other well-known interactional approaches, namely aptitude treatment interaction or ATI (Cronbach & Snow, 1977), in which interaction refers to a two-way factoral interaction effect upon outcome variables as a result of divergent levels of aptitudes (e.g., learning modalities) and instructional treatments.

The basis of an eco-behavioral approach to program evaluation derives from environmental determinism and can be traced to three different fields: behavioral ecology, (Barker & Wright, 1968; Bronfenbrenner, 1979); applied behavior analysis (Bijou, Peterson, & Ault, 1968; Patterson, 1982; Rogers-Warren & Warren, 1977; Wahler & Fox, 1981); and process-product research in education (Brophy, 1979; Dunkin & Biddle, 1974).

Behavioral ecology. Behavioral ecology (Barker & Wright, 1968) calls for the recording of events in the life of an individual in terms of behavioral settings; descriptions of the environment on par with descriptions of the subject's behavior. These behavior settings and their standing patterns of behavior are termed synomorphic relationships and their identification and description is the goal of ecological research. The ecology observed in a particular study may be defined quite broadly, as in the analysis of setting variables and their impact on children's learning and play behaviors (Gump, 1969). On the other hand, only specific aspects of the environment may be studied, such as group size (Barker & Gump, 1965), density (McGrew, 1970), and spatial organization (Prescott, 1981). In any event, the focus is upon the study of stimulus elements that provide the occasion for persons to behave. These events are often described through verbatim accounts, narrative records, and other less than quantitative methods.

Applied Behavior Analysis. The field of applied behavior analysis is founded upon the operant model of behavior, or the interaction of a setting event, discriminative stimulus, response, and reinforcing consequent stimulus. Assessment in applied behavior analysis emphasizes recording behavioral and environmental events in observable, quantifiable terms (Bijou, 1968, p. 175). Measures describing these events are coded into quantifiable units of behavior such as frequencies or durations and these are then combined across observation periods, analyzed, and interpreted. Descriptive studies in applied behavior analysis that have focused upon naturalistic observations of interactions between setting events, discriminative stimuli, behaviors, and consequences have been used to determine the stimulus control of deviant behavior (Karpowitz & Johnson, 1981; Patterson, 1982). Similarly, Wahler and his colleagues (Wahler & Graves, 1983) have examined the setting events for family interactions as a way of predicting successful or unsuccessful family behavior therapy.

Process-Product Studies of Teaching Effectiveness. A third perspective that has influenced the eco-behavioral approach to program evaluation has been process-product studies of teacher effectiveness (Brophy, 1979). Process measurement, the assessment of teacher behaviors, student behaviors, and other classroom stimuli (e.g., grouping, physical structure, curriculum, etc.) has been successfully used to explain academic products (outcome gains) of students resulting from instruction. Process measures are typically gathered through systematic observations of teacher and student behaviors (Flanders, 1970; Medley & Mitzel, 1963).

In fact, Brophy (1979) refers to process-product studies (teacher behavior-academic products) and process-process-product studies (teacher behavior-student behavior-academic products) in which what teachers and students do in the classroom is quantitatively described and examined in terms of academic gains in controlled studies.

The Analysis of Eco-Behavioral Processes

Eco-behavioral processes can be described in two basic ways. First, observations of specific variables can be statically scored, that is, the frequency of each coded event can be totaled and expressed in terms of the grand total of all coded events, as an unconditional proportion or percentage score. These proportions act as molar descriptions or session estimates of the relative rates of occurrence of each coded classroom event. Alternatively, classroom observation systems can be dynamically scored, that is, events that occur contiguously (those that co-occur in the same time interval or those that follow each other in subsequent intervals) can be combined to form conditional proportion scores. Summaries of these jointly occurring events can then be combined to form molecular descriptions, the conditional relationship between ecological and behavioral events. These classroom processes achieve added significance when they are related to product measures (gains in academic achievement).

Several studies have been conducted in regular classroom settings to determine the molar classroom processes that are related to student achievement. A review of process-product research by Rosenshine (1977) pointed to the following processes as significantly and positively related to school achievement gains:

1. Observed time spent directly on instruction as opposed to non-academic activities (Stallings & Kaskowitz, 1974).

2. Frequency of direct factual single answer questions by teachers instead of complex divergent questions (Brophy & Evertson, 1974; Soar, 1973; Stallings & Kaskowitz, 1974).

3. Student attention or on-task behavior as opposed to disruptive off-task behavior (Brophy & Evertson, 1974; Stallings, & Kaskowitz, 1974).

4. Student involvement in large group instruction rather than unsupervised independent study (Soar, 1973; Stallings & Kaskowitz, 1974).

A Case in Point

In our own work, we investigate molar and molecular processes using a sequential classroom observation system, the Code for Instructional Structure and Student Academic Response (CISSAR). The CISSAR (Hall, Delquadri, Greenwood, & Thurston, 1982; Stanley & Greenwood, 1981) focuses upon a single student for an entire school day and allows observers to record five major categories of ecological variables: activity, task, teaching structure, teacher position, and teacher activity. Observers also record three categories of student response variables (i.e., academic responding, task management, and competing, inappropriate behavior).

Data derived from the CISSAR code have been used for three major purposes:

1. To provide molar descriptions of contrasting educational settings and instructional approaches.

2. To provide molecular descriptions of co-occurring classsroom events and related student responses.

3. To conduct process-product analyses of academic achievement gain.

Molar CISSAR Results. Most of the molar descriptions using the CISSAR have been used to contrast inner-city and suburban schools. For example, fourth-grade teachers in inner-city schools were found to use different instructional tasks than teachers in suburban schools. In inner-city schools, fourth-grade teachers were more likely to use media (overhead projectors, films, etc.). In suburban schools, teachers were more likely to assign seatwork and allow students to work independently (Greenwood, Delquadri, & Hall, 1984). When the behaviors of students in these groups were compared, inner-city students were found to emit significantly less active academic responding than suburban students, even when IQ and socioeconomic status were statistically controlled (Greenwood et al., 1981). These differential findings are molar descriptions of classroom ecology and student behavior that are helpful in making global comparisons between programs.

Molecular CISSAR Results. Molecular descriptions of classrooms have revealed the diversity of ecological stimulus arrangements students experience within single lessons and the variability in specific academic behaviors temporally associated with each particular arrangement (Greenwood, Delquadri, Stanley, Terry, & Hall, in press). Analysis of the most frequently occurring ecological arrangements resulted in the identification of arrangements that accelerated or decelerated student's academic responding over a baserate, the molar average proportion of academic responding for an entire observational session. For example, the baserate probability for academic responding during spelling was .33 for the inner-city sample. The probability of academic responding increased to .62 when the following accelerator arrangement of variables occurred: Task: *Paper/Pencil*, Structure: *Entire Group*, Teacher Location: *At Desk*, Teacher Response: *Not Teaching*. In contrast, the probability of academic responding decreased to .04 when the following arrangement occurred: Task: *Teacher/Student Discussion*, Structure: Entire Group, Teacher Location: In Front, Teacher Response: Teaching.

Process-Product CISSAR Results. Process-product analyses using the CISSAR have been used to find the best predictors of student achievement among the student response variables. Greenwood et al., (1984) reported that a composite of seven student behavior variables, termed academic responding, was most predictive of achievement (.42). The individual behaviors of writing and silent reading were also significantly correlated to student achievement. Attentive behavior defined as looking at the teacher, the lesson, or a peer answering a question was not a significant correlate of achievement.

In a second line of research, functional analyses of instructional interventions have shown that important changes in eco-behavioral processes co-vary with gains in student achievement (Greenwood, et al., 1984; Greenwood, Dinwiddie, et al., in press). These changes included: increased use of paper/pencil and reduction in teacher-student discussion, location of the teacher among and to the side of students, rather than in front or at desk, increased teaching behavior, etc. Thus, it has been demonstrated that an eco-behavioral approach can define the ways classroom variables effect student behaviors and subseqently, student achievement. However, the question remains: "Can this methodology work in evaluating early intervention programs?"

A Prototype Eco-Behavioral Approach for Evaluating Early Intervention Programs

The real need at present is the development of an eco-behavioral code that captures important instructional interactions that occur in classrooms for handicapped preschoolers. This instrument must be complex enough to assess both the diversity and sequence of ecological variables, teacher behaviors, and student responses in the preschool classroom. A sample prototype observational code being developed by the authors appears in Table 5. An expanded version of this instrument will be used to assess

eco-behavioral processes for a single student observed during individual sessions or spanning an entire preschool day. Students' observation records will then be summarized to provide the following descriptions of classrooms:

1. Molar descriptions of preschool programs derived by computing the percentage occurrence of each variable on the code. These descriptions will be statements about the classroom ecology, such as the percentage of the preschool day spent in specific activities, and in what types of structure, grouping, and composition of handicapped/nonhandicapped students in which activities occurred. Similar descriptions can be made about the proportion of the day that the teacher engaged in various behaviors and likewise the types of behaviors the students

emitted.

Table 5

Preschool Observation System for Measuring Eco-Behavioral Interactions

Ecological Categories	Description	Code Examples
Designated Activity	The subject of instruction	Free play, Pre-academics, Language, Fine motor
Structure	The amount of structure provided	Teacher-directed, Teacher-guided, Child-guided
Materials	Objects which the student engages or attends to	Manipulatives, Art materials, Large motor equipment
Location	Physical placement of the observed student	On floor, At tables, On equipment, In chairs
Grouping	Size of group in same activity as observed student	Small group, Large group, Whole class
Composition	Mix of handicapped and non-handicapped students in instructional group	All handicapped, Mixed, All non-handicapped
Teacher Behavior Categories	**Description**	**Code Examples**
Teacher Definition	Primary adult interacting with observed student	Teacher, Aide, Student teacher, Ancillary staff
Teacher Behavior	Teacher behavior relative to observed student	Verbal instruction, Physical assisting, Approval, Disapproval
Teacher Focus	Direction of teacher's behavior	Target child only, Target child and entire group, Other than target child

Table 5 Continues (pg. 2)

Student Behavior Categories	Description	Code Examples
Appropriate Engaged	Specific active on-task responses	Fine motor, Gross motor, Pre-academics
Appropriate Non-Engaged Transition	Prerequisite or enabling responses	Waiting, Looking for materials,
Inappropriate	Behaviors which compete with appropriate, engaged behaviors	Disruptive, Inappropriate play, Off-task
Interaction	Verbal or non-verbal engagement of a peer or adult	Verbal interaction with peer, Verbal interaction with adult

2. Molecular descriptions of programs derived by computing the conditional probabilities of various combinations of variables on the code. These descriptions will make possible the following types of statements: "Given a specific type of activity or materials, in what types of behavior was the student most likely engaged?", "Given a specific classroom structure or instructional grouping, in what types of behavior is the teacher most likely to be engaged?", and "Given a specific teacher behavior, in what type of behavior is the student most likely to be engaged?".

3. Process-product analyses will be conducted by correlating specific eco-behavioral processes with outcome measures such as gain scores on developmental tests or measures of successful transitions to post-preschool environments.

These three types of descriptions can be used in several ways to evaluate early intervention programs. First, they can form the basis for defining the program variables across different types of preschools in a quantifiable manner. For example, programs embodying different philosophies (e.g. behavioral, Piagetian, or Montessori) can be qualitatively and empirically described and contrasted across variables like the activities and materials provided, and the behaviors engaged in by teachers and students. In a similar fashion, programs that reflect different service delivery models, such as mainstream programs versus self-contained, or half-day versus full-day programs, can be contrasted.

Second, molar and molecular descriptions can be used to examine the fidelity of program replications. If an original program model can be quantifiably described across a variety of dimensions, such as the content that is taught, the materials used etc., then those quantified dimensions can become a template against which replications can be compared.

Third, the molar and molecular descriptions can provide a means of documenting specific changes in programs. Some examples of programmatic shifts that could be monitored are: changes incurred by the institution of a new curriculum; changes brought by a shift in the classroom population, such as the integration of non-handicapped peers into a program; or changes brought about when a teacher decides to systematically alter some behavior, such as the rate of "approval" statements. If data are gathered on students in the program both before and after changes are made in the classroom, molar and molecular descriptions derived from observational records can be analyzed in time-series fashion to document shifts in the specific independent variable being manipulated (e.g. activity, composition of group, teaching behavior). At the same time, changes in student behavior that co-occur with the program variable alterations can be monitored.

Fourth, the molar descriptions of student behaviors can be used in process-product analyses to determine the specific classroom behaviors that are most related to developmental gain. This type of evaluation will allow early intervention programs to determine the skills that are most predictive of developmental gain. This type of information will help program developers in choosing the behaviors (e.g. pre-academics, free play, language) that will be the focus of the program.

Fifth, the molecular descriptions of eco-behavioral interactions can then be used to make precision diagnoses of instruction, that is, a determination of the specific combination of ecological and teacher variables that are most related to the classroom skills and that are critical to the enhancement of developmental outcomes. These instructional variables can then be the variables targeted for improvement.

Summary

What has been described is a powerful methodological improvement for use in the next generation of efficacy studies. Unlike many approaches in which the child is the center of assessment (e.g., aptitude-treatment-interaction and much of applied behavior analysis), the eco-behavioral approach will expand the focus of assessment to account for both the independent and dependent variables to explain student outcomes. Obviously, the suggestions for using this methodology that are discussed above are only a starting point for many new and different applications. Indeed, a truly exciting feature of this methodology is that measurement of the independent variable allows us to ask a whole new set of questions. These questions have never been asked at the level of quantitative analysis about early intervention program processes and outcomes.

Very simply, an eco-behavioral approach to the educational evaluation of preschool programs will allow definition of interactions between programs and behavior in a precise empirical fashion. Program outcomes may be examined and interpreted in terms of the indices of treatment received. This will dramatically improve our ability to design, deliver, and support early intervention programs.

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CHAPTER VI

ECOBEHAVIORAL ANALYSIS WITHIN THE FIELD OF BEHAVIOR ANALYSIS

GARY B. VERNA

Abstract

In 1976 a conference held at the University of Kansas brought together a group of ecological and behavioral psychologists to discuss issues related to the work in each discipline, concerns from across disciplines, and areas of substantial agreement. The purpose of this paper is to examine some of concerns raised by ecological psychologists with the field of applied behavior analysis. The intent of this discussion is to determine areas of potential development within applied behavior analysis that may be necessary and profitable in the development of an eco-behavioral science.

Introduction

In the mid 1970's a concept was coined and added to the currency of behavior analysis, i.e., ecobehavioral analysis, which like the Susan B. Anthony dollar appears to be still seeking its place in everyday commerce. At that time interest in, as well as concern over, the prospects of an ecobehavioral approach to behavior analysis seemed high. The term had been spurred by arguments from ecological psychologists that behavior is a part of a delicate system of interdependencies such that if a single behavior were changed there would likely follow other, unanticipated changes.

The height of the discussion between ecologists and behavior analysts was reached at a conference held specifically to address ecological concerns with behavioral analysis at the University of Kansas in 1976. The proceedings from that conference were published in a volumne edited by Rogers-Warren and Warren (1977) and included papers presented by ecologists and behavior analysts. Of particular concern to ecologists at that conference was whether the science of behavior analysis was capable of accounting for, let alone was sensitive to, the broader ecological network within which behavior was embedded. That concern is the focus of the present paper.

Most of us have forgotten the Susan B. Anthony dollar. It was irregular in shape and, therefore, awkward or uncomfortable to have in one's possession. We were often, while thumbing through a hand full of change, at a loss as to what it

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represented. To make matters worse, the coin did not appear to have an appropriate place in the natural community of currency exhange. Others were often intolerant of receiving it as legal tender. It did not fit into devices for which other coins had already been used with proven success. Indeed, the coin was inconvienent to have around. Accordingly, it might be safely suggested regarding the Susan B. Anthony dollar that, prior to its issue, there was not a natural community poised for its entry. Is the same true of eco-behavior analysis?

The argument that I would like to make is that both ecologists and behavior analysts would benefit from a continuing dialogue over ecological-behavior relationships, provided each science articulated eco-behavioral concerns *from within its own framework*. However, this dialogue awaits the commitment to eco-behavior analysis by the larger community of behavior analysts. I shall argue also that, an eco-behavioral approach indeed has a place in the larger community of behavior analysis. And, although important work toward this end has already begun (Baer, 1982; Baer & Wolf, 1970; Greenwood, Delquadri & Hall, 1984; Larson & Morris, 1983, Wahler et al., 1977, 1978, 1981), considerable work is yet to be done in order to provide for its entry into this larger community of psychologists. In particular, a number of concerns both within and without behavior analysis need to be addressed before either or both of the above goals can be reached.

Concerns Are To Be Addressed

Outside the field of behavior analysis, a number of questions have been raised regarding whether as a system it can adequately represent ecological-behavior phenomena. Within behavior analysis one factor in particular stands out. The development of an eco-behavioral approach makes considerable demands on a science of behavior. First, as Wahler and his colleagues (Wahler, Breland, Thomas, & Leske, 1977; Wahler & Fox, 1981) have pointed out, an eco-behavior approach raises considerable question regarding the relative emphasis to be given specific factors within the traditional three-term contingency operant paradigm (SD-R-Sr+), as well as raises question concerning which parameters of the stimulus-response elements are functional. In addition, to address eco-behavioral relationships requires considerable empirical effort in the form of data collection, analysis, and reliability in order to identify valid relationships between the behavior of the organism and the broader social and physical environment within which the behavior is immersed. Both of these activities may have considerable negative stimulus function, that is, negative reinforcing consequences, for the behavior analyst. In compensation for this effort, however, there are factors which operate in favor of an ecobehavior approach. For example, the issue of side effects, as discussed by Willems (1973a, 1973b), and the related behavioral concern with response classes, have yet to receive the systematic attention they deserve. Next, within behavior analysis there attention they deserve. Next, within behavior analysis there remains the need of developing more effective means for generalization and maintenance of behavior---little progress toward this goal seems to have taken place since Stokes and Baer (1977) published their, now classic paper addressing the problem. However, one very promising approach which they discuss focuses on the poised natural community of reinforcement (Baer & Wolf, 1970), with already practiced, effective schedules of reinforcement in operation waiting only for the correct behavior(s) to be emitted. In other words, they suggest that the behaviorist take advantage of the broader ecology of social stimuli in order to maintain and generalize behavioral treatments.

Future investigators may well profit from approaches, such as the natural community of reinforcement, which are more sensitive to the molar environment, that is, the broader natural community and which seek a more systematic accounting of this environment's role in shaping and maintaining behavior. It is precisely this consideration which separates the eco-behavior approach from the traditional behavior analytic approach. Specifically, an accounting of the natural community and its functions does not easily follow from the current body of research in behavior anlysis. Demonstrations of how the principles of behavior are used to manage behavior in a training setting/or situation do not tell us how behavior is managed in the natural situation. Neither, as the evidence on generalization and maintenance suggest, does it tell us how to gain entry into the natural community of reinforcement in order to support new behaviors, nor how to poise the natural community to receive new behavior when appropriate contingencies are not already present. It can be argued with some success that development of a technology of behavior over these past fifteen or so years has provided us with considerable evidence of the efficacy of its principles in what might be, to coin a term: "the built environment"---specifically the training setting or situation. It has also provided us with evidence of successful modification of behaviors that make less demand on the natural community, either for cuing or support of behavior. However, it has provided less systematic research regarding how these same principles operate in the natural community.

We benefit much from a closer examination of the ecologist's concerns with behavior analysis, since they represent important setting events for what may develop to be an eco-behavior approach within behavior analysis. The most important of these concerns were presented at the Kansas convention; accordingly, comments here will be limited to the arguments presented by ecologists at that convention.

Specific Issues

Although ecologists (Gump, 1977; Willems, 1977) focused on somewhat different issues, a single and clear message was provided behavior analysts. The message was that behavior analysis was in trouble, whether it was in relation to dealing with side-effects or handling larger segments of environmental-behavior interactions (e.g., whole classrooms, schools, hospitals). For example, Willems (1973) pointed out that behavior analysis had not adequately accounted for the ecological impact of its interventions to modify specific target behaviors in the individual. In attempts to change specific target behaviors, they argued, there are often unplanned-for consequences of direct intervention in the natural environment. According to Willems, behaviorist thinking about these these unplanned treatment effects, as either incidential or as the result of poorly controlled manipulation, denies the functional role played by the larger environmental context. Gump (1977) also pointed out that behavior analysis has chosen to deal with only a narrow and unique portion of the environmental context in which the person and his/her behavior are embedded. Gump's concern was not so much one of whether the behavior analyst recognized that the larger environmental context existed---he believed that they do, but whether the recognition of the larger context will become a legimate concern of behavior analytic science.

Similar concerns also have been voiced from within the field of behavior analysis. Wahler and his colleagues (Wahler, et al., 1977, Wahler & Fox, 1981) argued that the problem with behavior analysis is its narrow scope, that is, its predilection toward the measurement of only a few responses and their dyadic settings.

Ecologists had other concerns besides what they considered the narrow or molecular temporal-spatial context within which behavior analysis operated. Gump continued his argument by suggesting that the field of behavior analysis may lack sufficient scientific resources for extrapolation to the larger ecological situation. Willems sharpened this argument. He pointed out that knowledge about the principles that characterize and govern the systems into which the analyst must intrude to alleviate human suffering is necessary. This position raises a host of metatheoretical as well as theoretical and methodological problems. In elaborating his point he stated, "When operant technology is applied with a particular behavioral outcome in mind and the result is outright failure, marginal success, or some vexing behavioral drift over time, it is easy to assert that no larger, system-wide problem or no theoretical problem has arisen...I submit that there is a theoretical issue here that has to do with assumptions and predictions not borne out and with the overall adequacy of the operant view of behavior to deal with behavior-environment phenomena.

It is clear that behavior analysis was being attacked on at least two general levels. We would error greatly, however, if we did not separate our response to these different concerns. Each level of concern calls for a different type of response as well as has different implications for the prospects of an eco-behavior approach. At the first or descriptive level of concern, ecologists were arguing for research that: (a) admitted the possibility of complex interdependencies between behavior and the broader social ecology and that (b) added procedures that allowed their detection and measurement when they occur. The first of these concerns requires little effort on the part of behavior analysis to satisfy. A number of activities can be cited which are valid examples of the behavior analyst's interest in the broader ecological context. This can be documented as far back as 1948 when Skinner published his novel Walden II. This utopian community not only extolled the virtue of contingency management, but also gave considerable space to environmental management. As Gump points out in his analysis of Walden II, 100 behavioral settings were mentioned and over thirty of these were described in some detail by Skinner. Through one of the characters, Frazer, we are told that small communities are preferred to larger ones. From the standpoint of contingency management, small communities would allow more opportunities for contact and, presumably more opportunity for better arrangements of reinforcement contingencies. Another excellent example of the behavior analyst's concern with the broader ecological context is Baer and Wolf's (1973) discussion of how the natural community could be used to maintain behavior after treatment. They pointed out that for some problems the behavior modifier may discover that there exists already an effective community of peers socially skilled behavior modifiers, practiced, effective, and waiting only for an introduction of the subject. Baer and Wolf did not present a functional analysis of how the natural community was poised or operated to maintain the behavior of an individual introducted into it; instead they drew attention to an analogy---what we theoretical behaviorists call a model. It is worth our time to consider this model as it leads naturally to the methodological concerns voiced by the ecologists. The model was one of a mouse trap---a rather grim analogy.

Never the less, the essence of a trap in behavioral terms, according to Baer and Wolf, is that only a relatively simple response is necessary to enter the trap, yet once entered the trap cannot be resisted in creating general behavioral change. For the mouse, the entry response is merely to smell the cheese. Once it enters, the trap accomplishes massive behavior change. Also the modification has thorough generality: the change in behavior will be uniform across all environments, it will extend to all of the mouse's behavior, and it will last indefinitely into the future. Finally, the trap affords a great amount of behavioral change by a relatively slight amount of intervention by the analyst. For those of us who are experienced mouse trappers, it doesn't take much effort to recall that there is more operating in a mouse trap than simple contingency management of the mouse's behavior. That is, there is certainly more operating here than providing an appropriate discriminative stimulus (bait) and powerful consequence. There is considerable environmental management as well. For example, it is no minor trick getting the trap poised to carry off its task. Traps have idiosyncracies which not only differ one trap to the next but which make it necessary to learn what those idiosyncracies are in order to set them. There has been many a time when a trap was set, operated appropriately, but where the mouse escaped. Sometimes we use too large a trap for the size mouse we seek to catch or one which requires greater force on the part of the mouse to set off the trap than it is capable of emitting. Finally, it is possible that some mice do not like the smell of cheese.

The point of these two examples is simple, yet illustrative of behavior analysts existing commitment to the ecologists concerns with the descriptively molar environment. First, both examples indicate a concern with contingency arrangements within the broader ecological context. Both emphasize three important elements of any ecology from the standpoint of contingency management: (a) setting availability, (b) response opportunity and, (c) the network of naturally occuring reinforcers. Next, both provide for the recognition that more is involved in the successful operation of a community or trap than simply the provision of discriminative stimuli and reinforcing consequences. Human ecologies, like mouse traps, are not arbitrary settings. The settings in which people behave have an evolutionary history just as the humans who inhabit them. That is, their features, have function. It may be that their most important function is to occasion reinforcing consequences instrumental to the shaping and maintenance of appropriate behavior, as well as occasion the extinction of inappropriate behavior. Yet, we know very little about ecologies for natural communities. Behavior analysts know very little about how the natural community performs its functions. We simply have not been collecting the type of data which documents these functions of the natural community. What we need at the descriptively molar level is the same commitment to systematic, functional analysis that has characterized behavior analysis at the molecular level. It is this fact, more than anything else that has drawn the attention of ecologists to behavior analysis. We now consider some additional points.

First, there has been considerable confusion regarding the relationship between particular methodological procedures, (i.e., naturalistic/descriptive versus experimental/manipulative approaches, and the pursuit of molar phenomena. Specifically, it has been argued by behaviorists that, because ecologists use naturalistic methodology, molar phenomena can only be studied descriptively. Bijou, Ault, and Peterson (1968) form within the field of behavior analysis, and Willems and Rusch (1969) from within the field of ecological psychology, have similarly addressed this point indicating there is no isomorphic relationship between the phenomena of interest and a particular research methodology (Bandura, 1981). Both groups have gone on to suggest that with respect to methodology, a pluralistic approach would be advantageous within their respective fields.

The second type of concern raised by ecologists regards questions about behavior analysis as a science. Does it have the resources to deal effectively with molar phenomena? There are three possible interpretations one can give to this concern.

Let me separate two of them. The scientific basis of radical behaviorism, as with methodological behaviorism, is what might be termed "theoretical behaviorism." Accordingly, we need to ask if the ecologists concern with behavior analysis is a concern with the behavioral or theoretical aspects of behaviorism (Spiker, 1973).

Behaviorism names a commitment to two major points. First, as originally proposed by Watson (1913), the primative, undefined terms of the psychological language need not differ from those of the physical and biological sciences. Spiker (1973) referred to this as the definitional tenet, and by Kendler and Spence as the operational tenet, of behaviorism. Second, given this basic tenet, the task of psychologists is to find process laws about behavior. Admittedly, radical and methodological behaviorists differ as to how to organize laws into theories as well as when theory construction ought to begin; nevertheless, they are agreed on the two points just mentioned.

An examination of ecological literature suggests that it is not the behavioral features but rather the theoretical aspects of behaviorism with which they are concerned. For example, in pointing out some basic similarities between behavioral ecology and behavior analysis, Willems (1973a) states that in general the ecologists and the behavior analysts place a great deal of emphasis upon empirical data. Both tend to focus upon what organisms do, defined quite physicalistically, in relation to the environment and tend to deemphasize the use of hypothetical constructs to represent what the organism feels and thinks. Similarly, with respect to representing behavior-environment interactions, both seek lawful relationships.

Despite these similarities, we ought not lose sight of the differences between these behavior sciences which need to be recognised and dealt with. For example, the focus of ecological psychology has been primarily centered around finding out what goes on in the natural community. Accordingly, its methodology has consisted of quantitative and systematic observation of naturally occurring phenomena with as little intrusiveness on the part of the investigator as possible. In contrast, behavior analysis has focused on indentifying socially significant concerns with behaving organisms and intervening to correct problems identified in the natural community. Empirically, behavior analysis focuses on what was done (the social problem), how it was done (intervention) and what was the outcome (social validity).

Ecological psychology on the other hand, takes a rather wide span or molar approach to studying behavior in terms of spatial-temporal dimensions. It is also interested in the long term effects of the interactions between broad environmental setting variables and the behaving organism. Also, it is primarily interested in raising questions such as, what is the pattern of interdependencies between organism-behavior-environment and what are the far reaching implications of changing either the responses of the organism or the setting in which the organism is immersed?

Behavior analysis, however, might be said to be more interested in behavioral incidents, specifically defined as discrete responses. Accordingly, its focus is more narrow or molecular, both spatially and temporally, dealing within the moment to moment framework of specific, discrete responses and the immediate stimulus or setting events surrounding them. In behavior analysis the environment is arranged carefully so as to optimize the use of discriminative cues, which either occur naturally or are produced by the investigator or his confederates. Through the process of operant strengthening in which responses are reinforced, discriminative stimuli come to control the emission of responses. Thus, independent variables are manipulated directly.

The advantage of this highly controlled operative procedure has been that behavior analysts can then make strong inferences regarding causal relationships. The unobtrusive, non-manipulative approach of the ecologists neither allows for this level of control nor this level of inference. Instead, ecologists look for nature-given comparisons (e.g., big versus small school differences). Rival hypotheses are tested or examined by internal checks of the natural ocurring phenomena being tested.

However, like methodological behaviorists, ecologists differ from behavior analysts in matters of theory construction. This leads us to a consideration of theoretical behaviorism, and to the final two interpretations of the ecologist's concerns. It is possible that, for ecologists, molar phenomena cannot be predicted, explained, and understood in terms of the molecular principles of conditioning; hence other, molar units and variables become necessary. That is, when we turn from a focus on specific, discrete responses operating in the well controlled context of intervention to systems of responses and/or numbers of individuals operating in multiple settings within the natural community, contingency management becomes less feasible and other units and variables become important to the prediction and control of behavior. There is one error of logic and one prescription being made here.

First, this argument confuses a preference for how to explain and/or write laws to represent these interdependencies with a preference to investigate molar versus molecular phenomena. Cairns (1979) made the same point when he proposed that social acts are embedded in a larger social matrix. This has implications for how one goes about understanding the nature and determination of social patterns. Thus, it seems possible to agree on the phenomena of interest generally, without agreeing on how to explain or write laws to represent it.

Next is the prescription. It may be that ecologists are not arguing against the use of a molecular language to represent molar phenomena, at least not in principle, but that it is specifically the language of contingency management that is insufficient to account for molar phenomena. It is difficult to say when a particular language is no longer adequate to handle the phenomena of interest. Probably, the best criteria would be that it has failed when another theory/or language was shown to predict and explain everything that the old one did, and in addition, correctly predict new phenomena that the old language did not. However, it is questionable if such a new theory has shown itself to meet these criteria. On the other hand, the ability of a new language to predict should not be taken to imply that Skinnerian conditioning principles are sufficient to account for molar phenomena. That is, it might be that behavior analysis would benefit, as Whaler and his colleagues have suggested, from further conceptual and methodological expansion.

These researchers have suggested that there has been too much emphasis on the response consequence side of the three-term operant contingency and not enough attention paid to the antecedent side of the contingency or reinforcement paradigm. Wahler and his colleagues (Wahler & Fox, 1981) have presented interesting data suggesting that mother's extrafamily social interactions may influence her interaction patterns at home. That is, events temporally far removed from the ongoing moment to moment interactions between a mother and her child may have significance for the nature of that interaction. Greenwood, Delquadri, and Hall (1984) have also shown that the antecedent/or setting events in the classroom predict academic performanc via their effect on student's opportunity to respond. Similarly, Epling and others (Epling, 19??) have pointed out that there may be a problem in the pursuit of interventions based on a principle that stipulates a relationship between behavior and its immediate consequence. However, evidence is increasing which supports that behavior is not always maintained as a result of contiguity between the response and the reinforcer. In environments where many sources of reinforcement are operating, behavior may be acquired and maintained on the basis of correlation between rate of response and rate of reinforcement. Behavior analysts, faced with a behavior problem, have traditionally sought immediately present events that can be altered to change specific behaviors. In some cases environmental events that directly follow behavior cannot be found. This last example not only supports the argument that behavior analysis may need to rethink the relative emphasis it currently gives to specific aspects of its paradigm, but raises another point which is important here.

Often times we are so used to looking in specific directions for explanations that we miss opportunities to expand our science in a direction that would yield more accurate predictions and better explanations. Specifically, it is suggested that behavior analysis may have been trapped from within partly by its past success as an emerging applied science. While it may have been strategic for behavior analysis to developed in the direction it has over the past fifteen or so years, it may be that its relative emphases have now become more problematic than strategic for its own expansion.

Trends Toward An Eco-Behavior Analysis?

There may be factors within behavior analysis that either militate against an eco-behavioral approach or at least are in part responsible for the slow rate of acceptance among the larger community of behavior analysts. One thing stands out as we examine the behavioral literature since Willems (1973a) published his first attack on behavior analysis. That is, there appears to have been little in the way of a direct response on the part of behavior analysts to the concerns he voiced. For example, Wahler (1980) in his review of the Journal of Applied Behavior Analysis found that between the years 1967-1977 only three references were listed under the discriptor "setting events." An examination of the same journal for the period 1978-1979 showed that no references to setting events had occured. The present author reviewed five major journals in the field of applied behavior analysis from 1977 to the present. Less than twenty articles from these journals was devoted to what could be labeled eco-behavior analysis. Likewise, no indication of a trend in increased publications was evident. It is perhaps not simply coincidental that during the past years there has been a technical drift in articles published in the Journal of Applied Behavioral Analysis and Behavior Modification. For example, Hayes and his colleagues examined the publication of JABA from 1968-1977. They found that studies which were devoted to the development and extension of behavioral principles in applied settings (systematic applications) were fast disappearing from the pages of the journal (35% in 1968-72 to 10% in 1977). However, methodological and purely technical (how to do it) articles have dramatically increased over the same period of time. Hayes et al., 19?? used their analysis of JABA to make two points. First, they argued that basic or conceptually oriented research was usuful to the applied behavior analyst. Next, there has been a decrease over the years in this type of research. At some point we need to ask when the technical drift experience has been sufficient to begin calling it a conceptual shift, that is, a shift toward a new agenda or priority for the field as a whole. It may be that time has come. I point out again the work that has yet to be completed regarding our understanding of response relationships, as in the case of response classes and side effects, as well as the work to be completed regarding generalization and maintenance of behavior. It is possible that the attitudes such a drift occasion in the minds of behavior analysts would make it difficult for the eco-behavioral approach to acquire the attention some of us expect it should receive. Added to this, the fact that eco-behavioral analysis may require commitment to a number of considerations including the following: (a) relaxation of the definitional tenet, (b) relaxation of experimental demonstration of functional relations at least for a time, (c) introduction of correlational data, and (d) considerable effort in data collection and analysis, and it may be that an eco-behavioral approach to behavior analysis may be relegated to the peculiar few, rather like coin collectors, who are attracted to oddities like the Susan B. Anthony dollar. Research will determine the outcome and in that regard workability not agreement will be the acid test of an eco-behavior approach.

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CHAPTER VII

CONCLUDING REMARKS

CHARLES R. GREENWOOD AND CARMEN ARREAGA-MAYER

The purpose of this monograph has been to serve as a forum for papers developed by post-doctoral scholars concerning the developing trends within an eco-behavioral approach to psychology, special education, and applied behavior analysis. These papers have demonstrated that only recently have researchers attempted to develop and assess ecological factors (i.e., natural stimuli, program variables, special education procedures) in a quantitative fashion and in temporal relationship with student behavior. The papers have pointed out that a quantitative approach to ecological factors is necessary if one wishes to: (a) define program events that children actually receive in the course of their daily activities in special education and (b) relate these events in meaningful ways to outcome gains (e.g., academic achievement) that result over time. In the past we have not had high fidelity measurement of ecological factors within our evaluation designs. Thus, we have problems monitoring the quality of educational programs, quantifying their content, and relating them to student progress.

The paper by Dorsey reviewed the literature relating to academic learning time as a quantified and directly assessed measure of educational process. The paper by Greenwood argued that variation in students academic progress is a function of variation in student's opportunity to respond and described a eco-behavioral day in the life of a student based upon data from a direct observation code. The paper by Arreaga-Mayer examined the literature concerning home and school eco-behavioral data that would explain the generally lower school achievement gains made by culturally and linguistically different students. She reported only a few studies using high fidelity eco-behavioral measurement. Of those few studies attempting to assess eco-behavioral variables, only low fidelity techniques (e.g., involving surveys and ratings), of questionable validity were used. The paper by Carta examined similar issues within the evaluation literature for early childhood special education. She also concluded that quantitative assessment of program factors is currently lacking. She proposed an eco-behavioral observation system for use in early child settings and evaluation research. The last paper by Verna examined theoretical and empirical issues related to current ecological developments within the field of applied behavior analysis. The paper examined issues such as side effects reported in applied behavior analysis research. Side effects are considered to be a function of a broader ecological field of variables which are not currently assessed in applied behavior analytic studies. The paper questions whether there is a mingling of ecological and behavioral psychology as some people have suggested or whether the two disciplines are simply persuing eco-behavioral phenomena from a parallel perspective, each with its own metholodology and unique points of view.

In contrast to traditional assessment approaches, it has been demonstrated that eco-behavioral interaction enables one to (a) display the structure and pattern of momentary ecology variables, for example academic instruction, and (b) behavioral relationships to this ecological structure. Eco-behavioral asssessment is dynamic, focusing upon changing situational factors and subject responses. As the Chapters in this volume have suggested, this approach is increasingly evident in the literature, however it is just beginning to have an impact on work in applied settings. The relative newness of this approach is due to the conceptual and metholodological issues reviewed in this volume, in addition to practical issues.

Perhaps the greatest practical problems, are the increased resources and costs associated with assessments of this type compared to traditional forms of assessment. For observational studies, large samples of data are required for individual subjects in order to conduct extensive studies of eco-behavioral interaction. These studies require computer assistance for recording, storing, and analyzing the data. Moreover, the statistical procedures for these data are relatively new and issues concerning serial correlation and violation of assumptions of independence remain to be solved. These costs may inhibit many applied researchers. In just the area of school-based assessment, we can point to no examples of eco-behavior interaction being used (e.g., for screening, placement, or progress monitoring, etc). However, with the seemingly endless development of electronic technology and its lowering costs, this approach becomes increasingly more feasible.

Programmatic studies based upon analysis of eco-behavioral interaction offer the ability to investigate many of the current issues and problems facing the field. These include (a) setting events and stimulus control, (b) the natural conditions surrounding development of specific behavioral repertoires, (c) maintenance and generalization of behavioral repertoires, and (d) interventions based upon precision interpretations of naturalistic events. Thus, an eco-behavioral interaction approach may prove to be an instructive development in behavioral and special education research.